DECEMBER, 1960

Plant Engineering®

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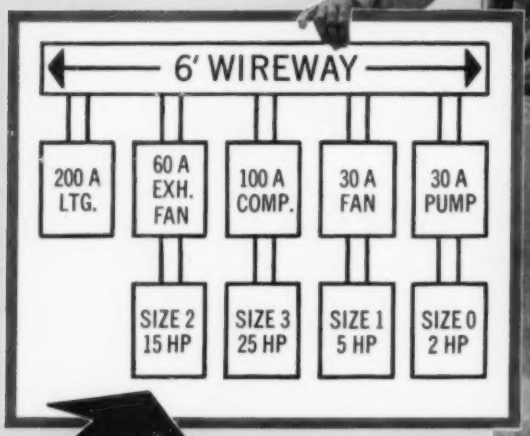
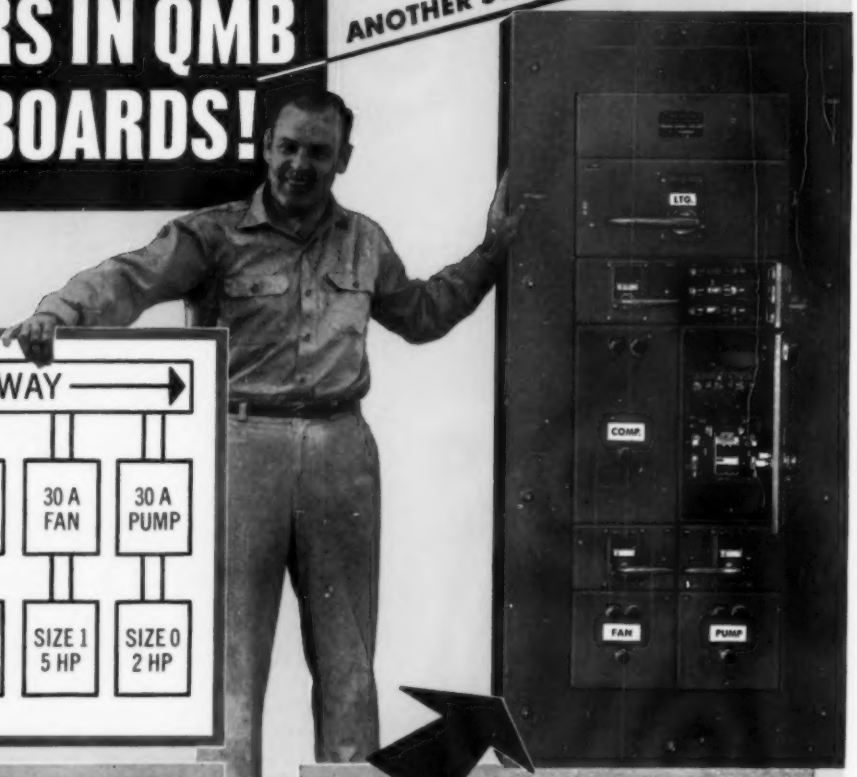
The magazine that helps plant engineers with their everyday problems

Volume 14, No. 12 Circulation of this issue 52,005

STARTERS IN QMB PANELBOARDS!

ANOTHER SQUARE D FIRST!





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41 HOURS AND 6 FEET
OF WALL SPACE TO INSTALL AND WIRE SWITCHES AND STARTERS LIKE THIS

IT TAKES
12 HOURS AND 30 INCHES
OF WALL SPACE FOR THE SAME INSTALLATION WITH A QMB STARTER PANELBOARD

QMB MEANS LESS TIME AND LESS SPACE PLUS

- **LOWER COST** • Time is money. The overall cost of QMB motor starters is usually less than that of separately installed starters and switches.
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- **ADDED SAFETY** • Interlocking prohibits opening starter or switch doors when switch is "ON."

QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 4. QMB switchboards and unit substations handle sizes 0 through 5. Part winding and two-speed starters available on order. All components available factory-assembled and wired. Enclosures, starters and plug-in switch units are also stocked by your Square D distributor for on-the-job assembly.

Notice how the PLUG-IN switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

It's easy to order these starter and switch units. See your latest Square D Digest for further information.

SQUARE D COMPANY

wherever electricity is distributed and controlled

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THERE'S POSITIVELY
NOTHING LIKE NEW GOODYEAR

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BELTS

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With Goodyear quality Positive Drive Belts now at your disposal, you're free to explore all these new avenues in machine or appliance design—

SMALLER SIZE—With Goodyear Positive Drive Belts, you can use smaller pulleys — shorter centers — narrower belts of higher capacities. Center distance can be permanently established.

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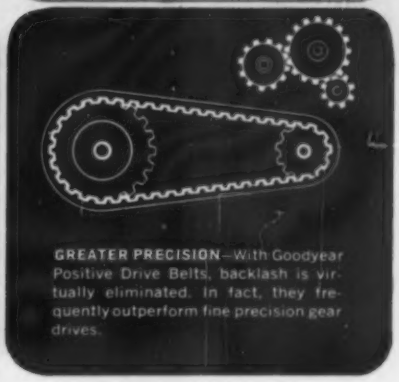

GREATER PRECISION—With Goodyear Positive Drive Belts, backlash is virtually eliminated. In fact, they frequently outperform fine precision gear drives.

And remember — Positive Drive Belts are designed and built to the famed Goodyear high standards of quality. For full details on belts for drives from fractional to 600 H.P.—for speeds up to 16,000 f.p.m., contact the G.T.M. — Goodyear Technical Man. He's available through your Goodyear Distributor — or by writing Goodyear, Industrial Products Division, Lincoln 2, Nebraska, or Akron 16, Ohio.

Goodyear Positive Drive Belts are manufactured under license and according to U. S. Patents 2,507,852 and 2,397,312.

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Plant Engineering December 1960, Volume 14, No. 12

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'ROUND ABOUT with the editors

Edited by R. L. Marinello

Scoop Looks Into Automation

Paul Fischer (left) Manager of Engineering Department, Micro-Path, Inc., Los Angeles, California, and Emil B. Skubik, engineering editor, Plant Engineering magazine, observe transistorized circuit modules of a numerically controlled positioning system which was discussed at a conference prior to the 1960 National Machine Tool Show. Replaceable boards are one maintenance feature.

Superintendent of Maintenance

Marshall W. Davies has been appointed superintendent of the Maintenance Department at the Cleveland Works of Jones & Laughlin Steel Corp.

He has been an employee at the company's Aliquippa Works for almost 33 years. He started as a general maintenance foreman at the Blast Furnace Department in November, 1926, and became assistant master mechanic of the department in August, 1929.

He was named maintenance foreman at the Seamless Tube Department in January, 1941, and became general maintenance foreman for the Seamless and Welded Tube Departments in February, 1946. He was appointed superintendent of the Seamless Tube Department in December, 1947 and became general maintenance foreman of the South Mills in November, 1955.

See You at Booth 601

DON'T FORGET to stop over and see us at Booth 601 during your attendance at the Plant Maintenance and Engineering Show in Chicago, January 23 through the 26.

We will give you the red-carpet treatment. In addition we are planning to have a number of chairs sprinkled throughout the booth so that you can set yourself down and rest awhile after a strenuous walk around the show. The booth will serve as an ideal spot to meet your fellow plant engineers. So, be sure to mark this down on your calendar of events during January—"Stop at PLANT ENGINEERING's Booth No. 601."

Machine Shop Short-cuts

AN IMPROVED method of bending plastic pipe, requiring less than a tenth of the time it normally takes, is one of 70 techniques and devices recommended by the Navy's Bureau of Ships for saving time and money in machine shop and other industrial operations.

The new way of bending plastic pipe involves the use of a steam chest to make the plastic pliable, rather than a live steam hose. The job can now be done in about five minutes, where it formerly took an hour. Other innovations suggested include a portable milling machine with two milling heads that operate simultaneously, an adjustable stop for countersinking holes in aluminum plating and a pressure gun for calking duct joints.

These and dozens of other solutions to a wide variety of machining problems are presented along with photos, diagrams and drawings. The booklet is identified as Bureau of Ships Shop Practice Suggestions (PB 161715). It is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., at a price of 50 cents.

Do You Have a Paint Finishing Problem?

IF THE ANSWER to this question is "yes," then you will want to check with the customer service department recently established by the Binks Manufacturing Company.

This customer demonstration and service department will perform the following duties:

1. Test and evaluate material samples submitted by customers and make recommendations as to the type of equipment that will best spray the material.

2. Conduct material and product application tests on all automatic and electrostatic equipment.

In addition to conducting tests on

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makes LYON your BEST SHELVING INVESTMENT

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There is a type of Lyon Shelving for every application—open, closed, bin, counter, sliding shelf, tool, mezzanine. Above—a typical tool room installation.

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• Lockers	• Filing Cabinets	• Bin Units	• Bench Drawers	• Shop Boxes	• Bar Racks	• Service Counters	• Wood Working Benches

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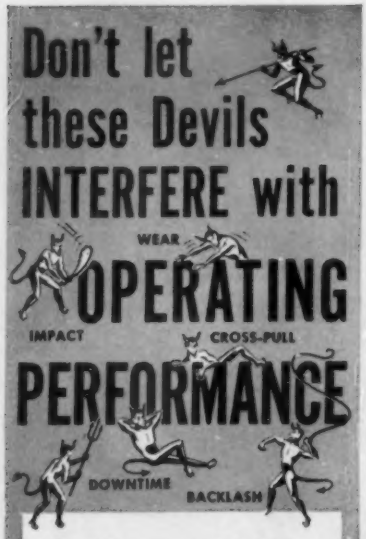

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'ROUND ABOUT

request, the department will maintain a permanent record of all tests conducted in the past. Information from these tests will be available on request.

For more information on this service, write Binks Manufacturing Company, 3114 Carroll Ave., Chicago 12, Illinois.

Appointed Plant Engineer

Daniel E. Zaremba has been appointed plant engineer of the industrial chemicals section at Pittsburgh Chemical Company, Pittsburgh, Pa.

He has been a senior project engineer for the industrial chemical section of the engineering department since November, 1959.

Prior to joining Pittsburgh Chemical Company, he was with the Shell Oil Company and Koppers Company. He is a chemical engineering graduate of Renssalaer Polytechnic Institute.

Ammonium Nitrate Fires

How AMMONIUM NITRATE behaves under fire conditions is covered in a new booklet published by the National Fire Protection Association.

With millions of tons of this chemical being used annually, precautions necessary for safe handling and storage are of importance to warehousemen, transporters and users. Fire and explosion hazards are of special concern.

Recommended firefighting procedures and storage methods are detailed in this booklet. Reprints of it—Ammonium Nitrate—Behavior in Fires—are available (at 25 cents per copy) from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

Don Wangelin Named Manager of Building He Helped Construct

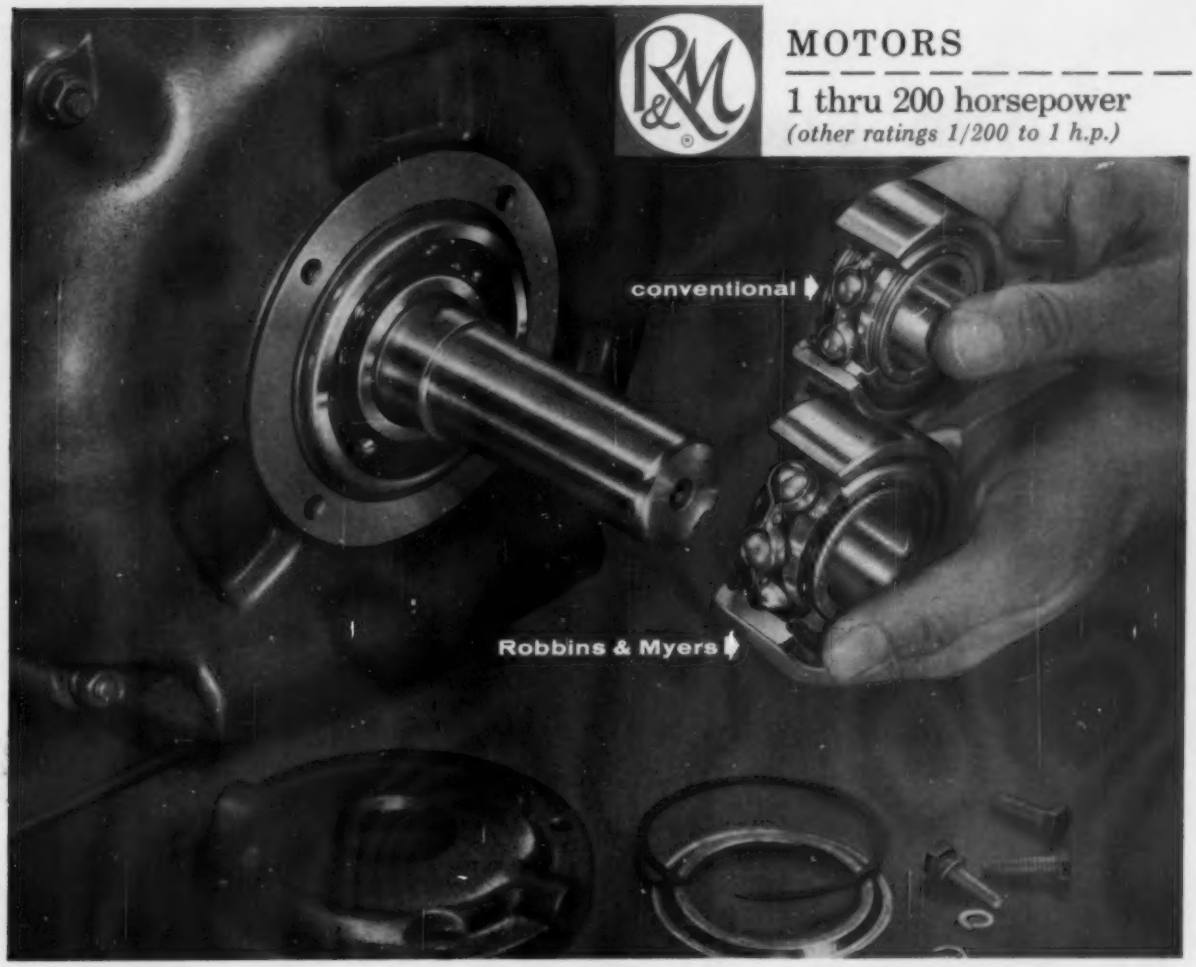
Don J. Wangelin has been appointed building manager of the Pure Oil Company's multi-million dollar general office building recently completed in Palatine, Illinois.

As manager of the building, he will be responsible for the operation, cleaning, maintenance and repair of the building and its equipment; office furniture and equipment maintenance, repair, movement and storage; building and grounds security and all building and cleaning trades functions whether performed by employees or independent contractors.

Don joined the company as a junior engineer in 1939. He became a research engineer in 1940, a group leader in 1943, a section leader in 1948, plant engineer in 1950 and division director in charge of the operation and maintenance of the company's Research Center located in Crystal Lake, Illinois, in 1958.

Since April 1, 1959, he has been assistant project engineer for the new Palatine general office building. His duties in this capacity have been to handle the relationship with the architect and general contractor during the planning and construction period of the building.

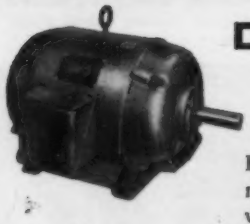
Season's Greetings
to
All Our Readers
from
The Editors of
Plant Engineering



MOTORS

1 thru 200 horsepower

(other ratings 1/200 to 1 h.p.)

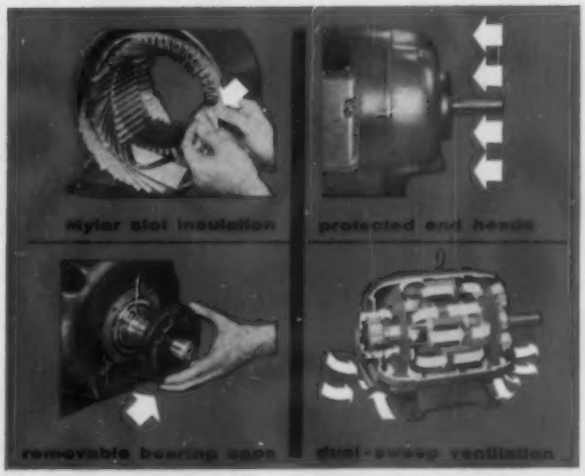


Double Width Bearings Hold More Grease...*Insure Longer Motor Life!*

Bearings in ROBBINS & MYERS motors run in double-width races with extra-large lubricant reservoirs. Bearings are fully sealed and pre-lubricated with laboratory tested grease which resists dust, temperature, humidity and high operating speeds. Tests prove these bearings can withstand six to nine years of severe service without relubrication. Bearings are further protected by metal seals on each side. Seals keep impurities out, prevent failure caused by "forgotten" lubrication or damaging over-lubrication.

R&M insures longer motor life with many additional features: Mylar* insulation that has 8 times the dielectric strength and 35 times more moisture resistance than ordinary paper insulation . . . removable caps for quick bearing inspection and relubrication . . . end heads that give full-height protection . . . dual-sweep ventilation for efficient cooling. For details, write today for Bulletin 520 PE

**DuPont registered trademark*



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motors, household fans, Propellair industrial fans, hoists, Moyno industrial pumps

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Mobilmet Oils

the first multi-metal cutting fluids...
with unique pressure-temperature selective activity.

This Tapping Efficiency Tester is one of many Mobil research tools used in the development of cutting fluids such as Mobilmet . . . effectively evaluates the machining efficiency of cutting oils on soft, draggy SAE 1020 steel. On this difficult machining operation as well as in field service, Mobilmet oils have demonstrated results better than conventional cutting fluids intended for this application. Other applications for new Mobilmet oils include: Turning, Drilling, Boring, Milling, Gear Hobbing, Shaping and Shaving, Threading, Tapping, Pipe Threading, Surface and Internal Broaching, Thread and Form Grinding, Thread Rolling, Forming and Special Automatic Screw Machine Operations.

in cutting-oil technology...

Now... from Mobil Research... versatile new cutting fluids that offer you: • greater machine output • lower tool costs • reduced loss from rejects... over wide ranges of metals and operations!

Now, after two years of exhaustive research and field testing . . . new Mobilmet* oils—the first multi-metal cutting fluids ever offered to the metalworking industry.

Mobilmet oils are uniquely versatile . . . help simplify your cutting oil requirements because each grade is effective over ranges of metals and operations beyond the capacity of any conventional product. And Mobilmet oils offer you superior machining results as well—in terms of improved finishes, longer tool life, and reduced staining.

Behind this versatility and effectiveness: a new additive composition, developed and patented by Mobil, which is *pressure-temperature selective* in its activity—highly effective over the wide ranges of cutting pressures and temperatures produced in machining various metals with greatly different physical characteristics. As a result, Mobilmet oils are useful for both tough, draggy metals and hard, brittle metals.

Call your Mobil Representative, or use the coupon below.

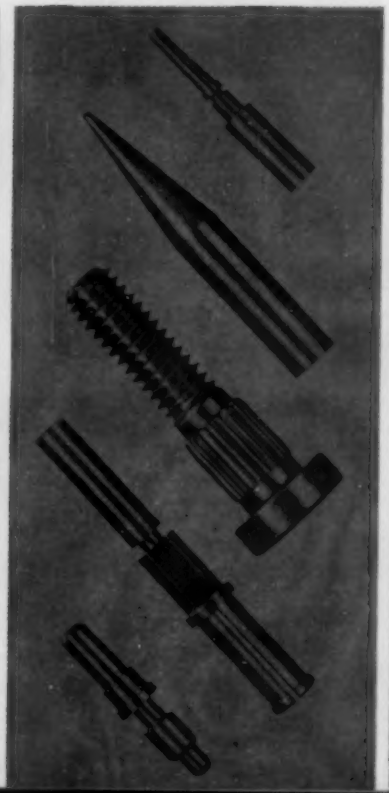
Mobil

*Mobilmet is a trademark of Socony Mobil Oil Company, Inc.

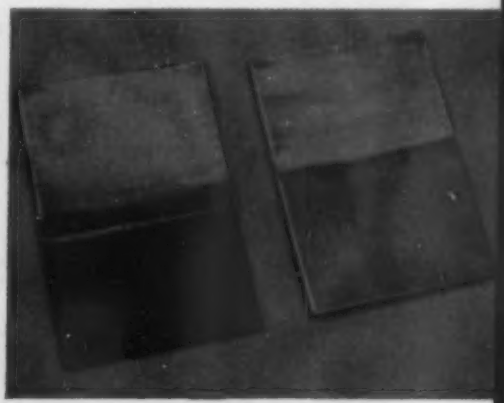
MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

Mobilmet oils offer superior tool life on both soft, draggy metals and hard, clean-cutting materials. These pipe threading chasers used for six weeks in moderately severe job-shop service show little wear on either tool faces or thread crests. Results were achieved with heavy-duty Mobilmet oil.

Since they effectively control built-up edge and tool wear, Mobilmet oils provide superior finishes that meet exacting specifications—with fewer rejects, and in some cases reduced necessity for additional finishing operations.



Stain-inhibiting effect of new additive combination is demonstrated with two steel plates. Plate on the left was immersed in conventional corrosive cutting oil; plate on the right was immersed in heavy-duty Mobilmet grade intended for the same application. Re-polished tops of plates show original condition.



Mobil Oil Company, Room 2057-G
A Division of Socony Mobil Oil Company, Inc.
150 East 42nd Street, New York 17, N. Y.

Gentlemen: I am interested in learning how Mobilmet oils can improve metal-cutting operations at my plant. Contact me about setting up an evaluation program.

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HELPFUL WATER CONDITIONING DATA FROM BETZ

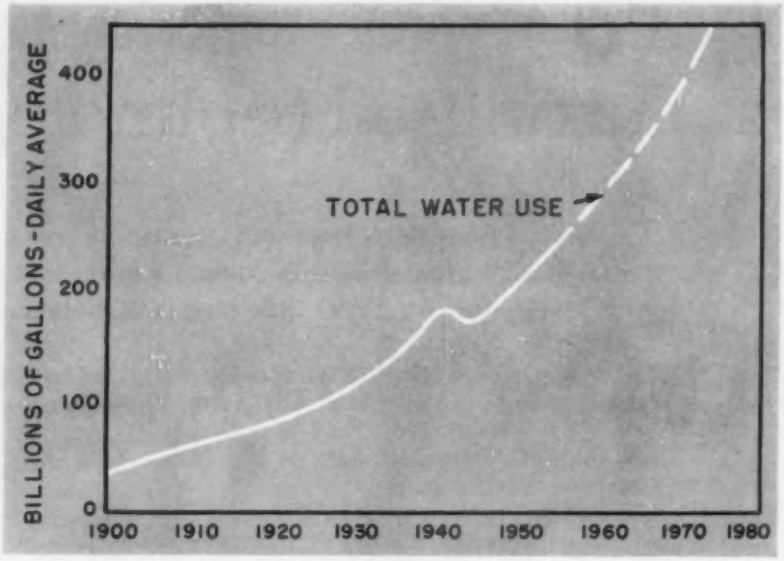

Figure 1

WASTING WATER IN YOUR

There are ample opportunities for the conservation of water in most industrial plants

WATER IS ONE of our most vital resources. Considerable concern has been expressed from time to time over the adequacy of our water resources. This concern is justified because of the enormous current water usage and the rate of increased usage predicted for the future as shown by Figure 1. The current water usage by industry alone is estimated as 70 billion gallons per day. It is anticipated that daily usage will soar to 115 billion gallons by 1975. Water requirements for various industries are typified by the data presented in Figure 2. With an expanding population and industrial growth it is important that serious attention by industry be given to the conservation and reuse of our water resources.

Industrial plants that are located in drought areas have been forced to cope with a water shortage problem much sooner than anticipated. In some of these cases, sewage plant effluent has been used for makeup to boilers and recirculating cooling water systems. The problems encountered in the treatment of sewage plant effluent to make it suitable for these purposes is thoroughly covered by Betz Technical Paper No. 138, a copy of which is available on request.

Many industrial plants located in other areas where water supplies have been considered adequate and inexhaustible, have found it profitable to conduct surveys of their water usages. Often, surveys of this type uncover unnecessary water losses, inefficient operations and equipment obsolescences. The correction of these conditions has led to a saving not only in water, but of dollars as well. A recent survey conducted at a chemical processing plant dramatically illustrates what can be done.

TYPICAL WATER REQUIREMENTS

Industry	Gallons per Tons
PETROLEUM	35,000
STEEL	65,000
PAPER	70,000
RUBBER	30,000

Figure 2

Case History

A chemical processing plant, considering an expansion program, found that the water supplies might not prove adequate for the anticipated operating conditions. The normal source of well water was already being supplemented by the use of city water which was already in short supply. One of the three wells normally used had been abandoned because of evidence of salt water intrusion. A simplified flow sheet of water usage for the plant is illustrated by Figure 3.

The survey revealed that a large quantity of hot condensate was being dumped to waste because of frequent contamination from process evaporators which introduced foam producing materials into the condensate. When this condensate returned to the boilers, severe boiler water carryover occurred.

Trouble also occurred with the lime-soda softener. The supplemental use of city water along with the normal well water created such a wide variation in makeup water characteristics that it was impossible to maintain proper balances. These poor balances resulted in the need for frequent backwashing of the filters and the maintenance of an abnormally high blowdown rate on the boilers.

The recirculating cooling water system contained numerous bleed-off points for miscellaneous water usages which made it uneconomical

to treat the system for prevention of corrosion. The corrosion products that accumulated were interfering with heat transfer, requiring added water flow to maintain process temperatures.

Briefly, the corrective measures applied involved the application of an *antifoam to the process evaporators* which eliminated contamination of the condensate. As a safety measure, however, an alarm system was installed which also operates a valve to divert the condensate, if and when contamination occurs. The return of the hot condensate materially reduced makeup requirements to the boiler so that the available city water proved more than adequate to handle boiler makeup requirements for the proposed operating conditions. With the use of city water alone for makeup to the boilers, uniform softener balances have been maintained and the filter backwash and boiler blowdown have been reduced to normal requirements.

Savings in heat, water treatment and water requirements far exceed the cost of the process antifoam and the cost of the alarm system used to correct the problem.

In addition, a check of the numerous draw-off points from the cooling system revealed unnecessary waste of water through open-ended hoses used periodically for washing equipment and left running. Cooling water for bearings and compressors was not returned to the main cooling water system. Elimination of these water losses permitted the cooling system to cycle and decreased makeup requirements to the point where the two existing wells could satisfy the water demands. These savings in water, in turn permitted corrosion control treatment to be justified economically. A check of the third well which had been abandoned for evidence of salt water intrusion indicated that the salt content was within a range to permit its use in the cooling system if necessary. This well was connected for emergency use to the cooling system. The effectiveness of the cooling water corrosion control treatment has limited corrosion of the steel parts in the system to less than one mil per year. Design temperatures and normal pressure drops through the heat exchangers are now maintained.

PLANT ?

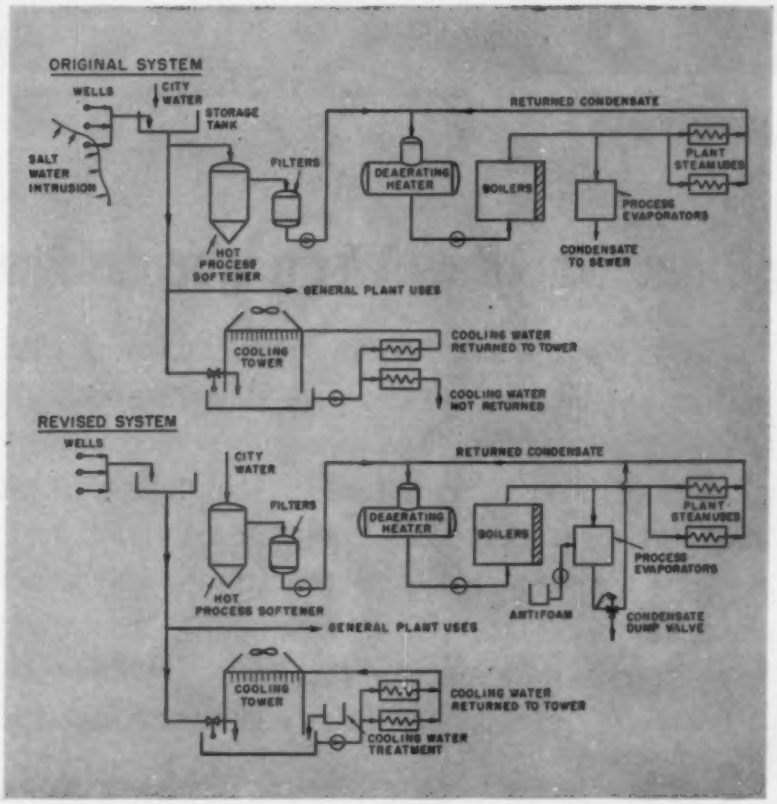

Figure 3

This survey and numerous others conducted by the Betz Consulting Division has revealed that there exist ample opportunities in many plants to bring about water conservation and oftentimes water re-use.

A survey of your plant water usages, treatment methods and water wastes may produce benefits both in water savings and dollar savings. Perhaps a process antifoam may be the answer. Talk it over with the Betz Engineer next time he visits your plant.

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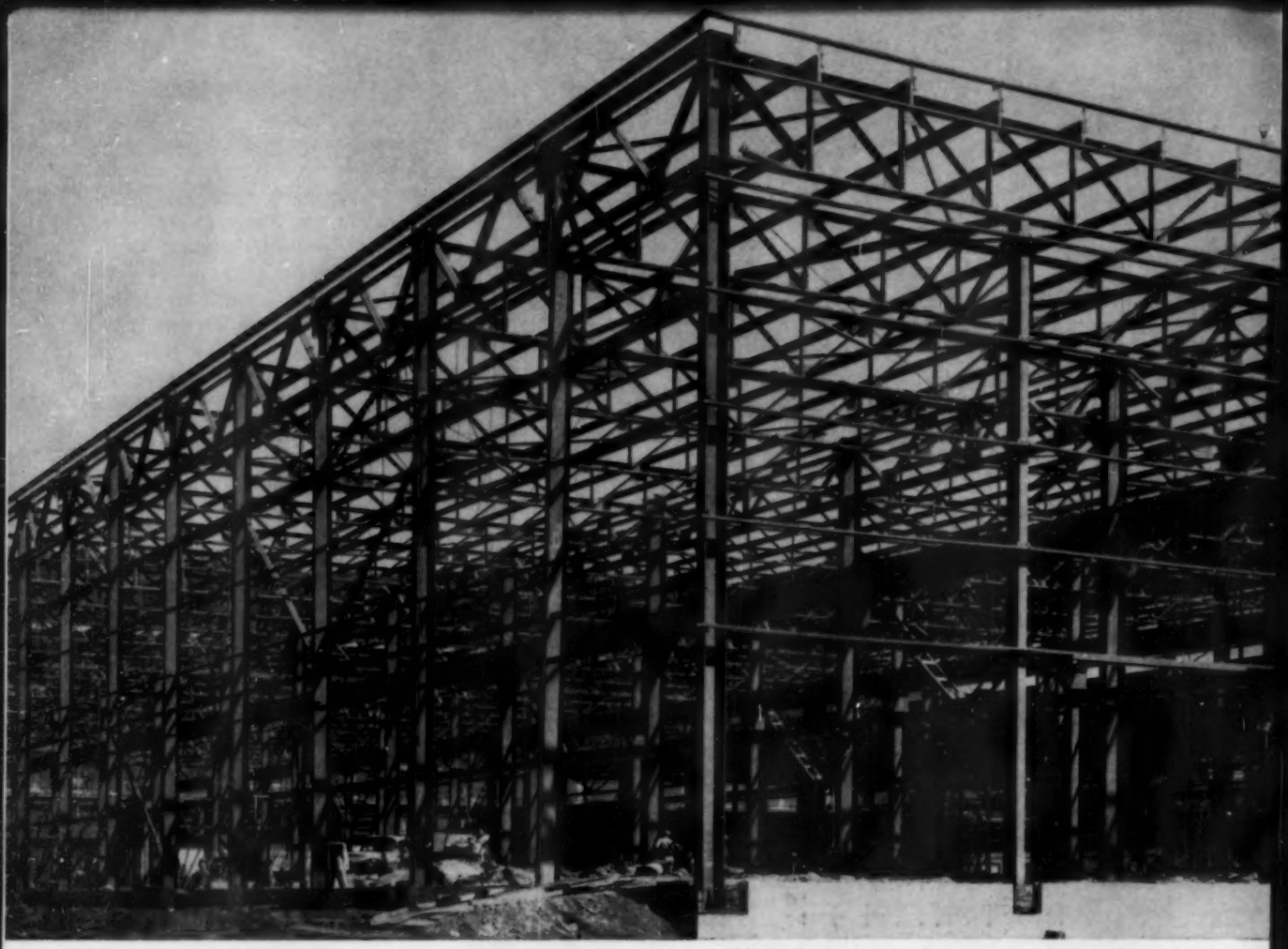
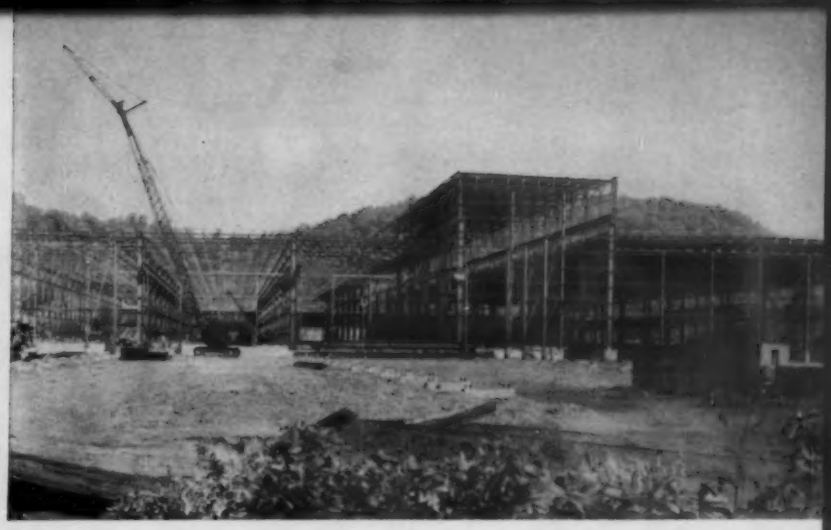
BETZ

■ CONSULTANTS ON INDUSTRIAL WATER PROBLEMS



Kaiser Engineers, General Contractor and Engineer, Oakland, Calif.

New Westinghouse Plant



fabricated and erected by American Bridge

Recently, American Bridge constructed a new Power Circuit Breaker Plant and Exterior Crane Runway at Trafford, Pennsylvania for the Westinghouse Electric Corporation. The building measures 420′ x 584′, the crane runway 334′ x 116′2″ and the entire job took 2,576 tons of steel. All connections were made by bolting and welding. ☐ Structural steel is ideal for industrial construction because its ease of fabrication permits complete design freedom. Structural steel also assures utmost strength and safety at a very reasonable cost. For your future industrial buildings, contact the nearest American Bridge contracting office for the facts on our services and facilities.

USS is a registered trademark

General Offices: 525 William Penn Place, Pittsburgh, Pa.
Contracting Offices in: Ambridge • Atlanta • Baltimore • Birmingham • Boston • Chicago • Cincinnati
Cleveland • Dallas • Denver • Detroit • Elmira • Gary • Harrisburg, Pa. • Houston • Los Angeles
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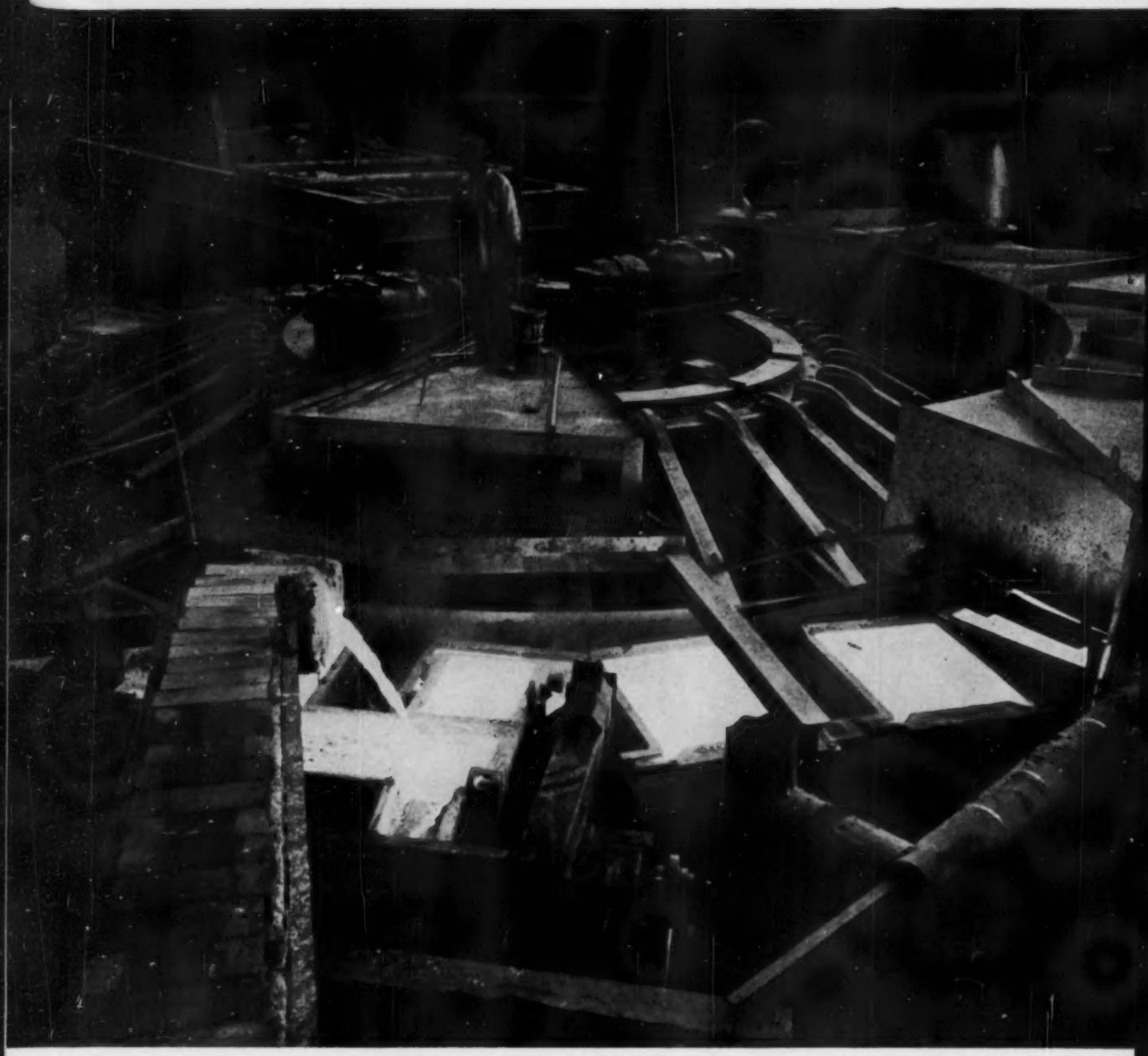
American Bridge Division of United States Steel

USS

For more facts circle 508 on Reply Card



Anode casting wheel. Here, molten copper arrives at 2100°F., and is cooled to less than 1500°F. in equipment at right. Gulf Pydraul is used in all hydraulic applications close to open flames or extreme heat. It's noncorrosive and fire resistant. Gulf Harmony lubricates wheel rollers. And Gulf E.P. Lubricant keeps the reduction gears in excellent condition.

Protects multi-million-dollar facilities against heat, sludge

GULF MAKES THINGS

The Kennecott Refining Corporation, Ann Arundel County, refines blister copper. It has invested over 30 million dollars in highly advanced production, quality control and materials handling equipment. Work force: 600 strong. So that's $50,000 worth of equipment per man.

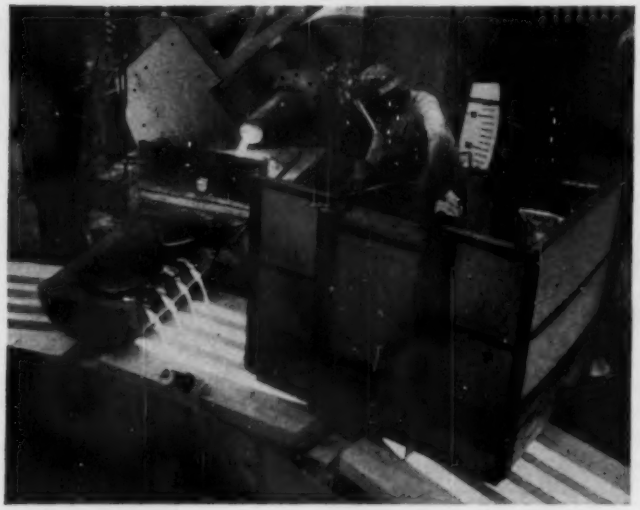
This heavily automated refinery demanded a simple, yet effective lubrication program. To set it up, the Kennecott maintenance staff worked closely with Gulf engineers. The result: a program that requires only a small number of Gulf oils and greases.

For instance, Gulf Harmony® oil is used in hydraulic systems that aren't exposed to extreme heat—assures smooth performance. And Gulf Harmony proves effective in other applications that require an oil with oxidation stability, water separation characteristics and sludge resistance.

Gulf E.P. Lubricants prevent excessive wear, keep maintenance costs low on equipment that undergoes shock loads and high pressures. Example: reduction gears on anode casting wheel and furnace chargers. A Gulf Sales Engineer reports that "The anode casting

Stripper conveyer. Pulleys and gears are sprayed with Gulf Harmony 76. It's foamless. It's stable. And it provides effective protection against fumes from the electrolytic cells.

Charging machine. It feeds pre-heated cathodes to the 90-ton, 13,500 KVA electric melting furnace. Gulfcrown Grease E.P. is used in the central lube system of all furnace chargers and the rotary pre-heating furnace. It's oxidation-stabilized and protects against rust.



Wire bar casting wheel. The refined molten copper comes from a small induction furnace off the main arc furnace. Gulf Lubcote lubricates the rim gear, drive pinions and guide rolls. And Gulfcrown Grease lubricates the flexible couplings and mold tipping rollers.

Left to right. F. A. Gaidis, Plant Engineer, H. E. Nelson, Machinist Supervisor, and J. E. Foos, Gulf Sales Engineer. A small number of multi-purpose Gulf oils and greases gives the Kennecott Refining Corporation a simple, yet effective lubrication program.

and wear with just six Gulf® lubricants . . .

RUN BETTER!

wheel's entire system was recently cleaned, and all reduction gears were in fine shape. No dirt or rust, or any indication of oil breakdown."

Gulfcrown® Grease E.P. is also specified for equipment that meets high pressures and shock loads. Gulf Lubcote® cushions gear-teeth sliding and rolling action on open gears. Reduces noise and wear. Finally, Kennecott uses Gulf Pydraul for hydraulic applications near open flames or high temperatures, and uses Gulfcrown Grease in a variety of conventional grease applications.

May we have the opportunity to work with you in setting up a similar money-saving lubrication program with multi-purpose Gulf lubricants? They'll help you cut maintenance costs and simplify lubricant application, storage and handling. Call a Gulf Sales Engineer at your nearest Gulf office. Or write for information.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 2, Texas

GULF

For more facts circle 509 on Reply Card

"Here at SCOTT we're paper men...

"We're specialists at SCOTT PAPER COMPANY.

"We produce a variety of papers and paper products that can display tenacious strength yet be as soft as felt; or can shed water or absorb it thirstily; or can exhibit the properties of materials other than paper.

"We needed only to look at ourselves, as specialists, to be assured that the OTIS specialist approach to elevator maintenance was best for us.

"Here at SCOTT, vertical transportation is a vital part of our production line. Our two OTIS Freight Elevators are used to distribute large rolls of paper and paper stock to production areas. Our two OTIS Escalators carry production personnel between production levels.

"Are we satisfied? We've been using OTIS ELEVATOR MAINTENANCE since the freight elevators and escalators were installed in 1955. Shutdowns have been held to an absolute minimum—by real OTIS professional maintenance."

What is the OTIS *specialist's approach* to elevator maintenance?
It is MEN . . . MATERIALS . . . METHODS.

MEN: Elevator maintenance is no one-man job. It is an organization task requiring experts in many lines. No individual, even if he devoted his entire time to the job, could do it properly. It calls for men with an unusual combination of skills plus long OTIS training in studying parts, assemblies, functions, replacement procedures, testing and adjusting. Some degree of elevator complexity can be gleaned from the illustration at right.

MATERIALS: Original OTIS parts and specially designed OTIS maintenance equipment are within one hour of 90% of all OTIS elevators in the U. S. for use in scheduled replacements—and to hold emergency shutdowns to a minimum.

METHODS: With more than 40,000 elevators under OTIS maintenance, OTIS has developed an actuarial procedure that replaces wearing parts well in advance of their breakdown point to hold shutdowns to an absolute minimum and assure the highest possible safety.

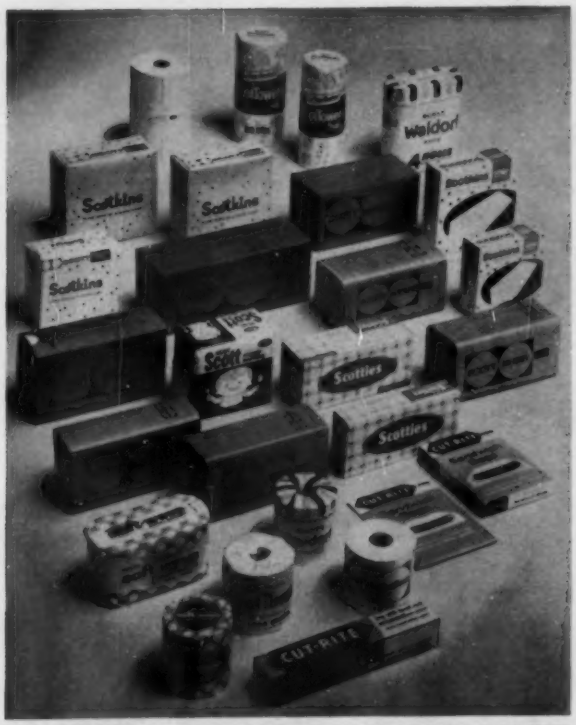
escalator and elevator maintenance

ASSURES CONTINUOUS PRODUCTION

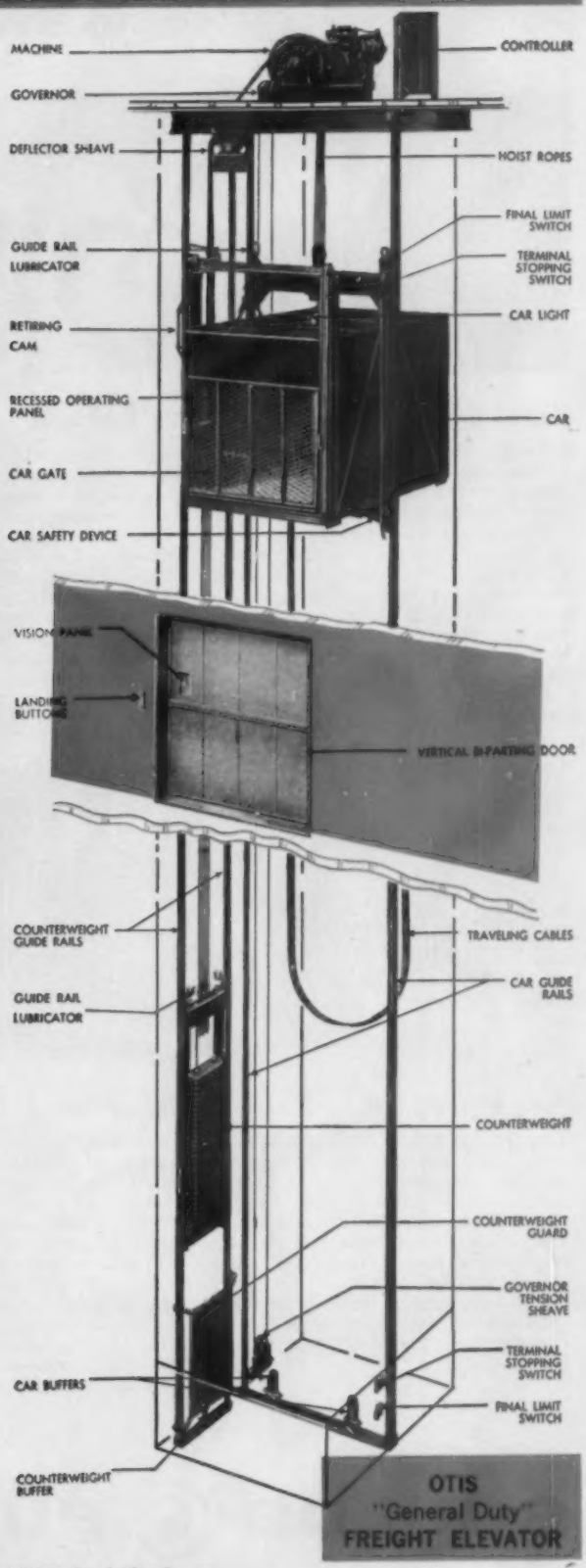
OTIS

OTIS ELEVATOR COMPANY • 260 ELEVENTH AVENUE • NEW YORK 1, N.Y.
OFFICES IN 297 CITIES ACROSS THE UNITED STATES AND CANADA

...not elevator maintenance men"



SCOTT PAPER COMPANY
WEST COAST DIVISION
EVERETT, WASHINGTON

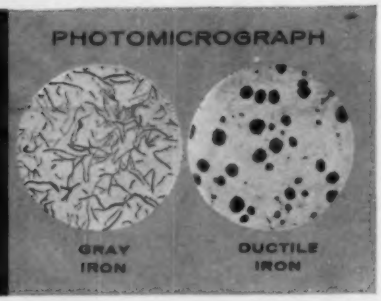


OTIS
"General Duty"
FREIGHT ELEVATOR

For more facts circle 510 on Reply Card

PUMPAGE

Goulds news about pumps for process industries



Glassed pump keeps tattletale gray out of light bulbs

Sylvania Electric Products Co. uses an abrasive slurry of hard fine phosphor particles in a xylol solution to coat the inside of its fluorescent tubes.

This slurry has always been hard to handle. It quickly eroded metal pumps which then contaminated and discolored the slurry. Discoloration increased rejects. A pneumatic system was tried . . . it needed constant monitoring and created a vapor hazard.

Sylvania engineers installed a Goulds-Pfaudler test pump, estimating a nine-month life would pay for the pump. *Over two years later*, the pump shows no wear or foreseeable future problems.

Sylvania now has four Goulds-Pfaudler glassed pumps, each running about 80 hours per week and handling 30 gpm of slurry against a 30-ft. head.

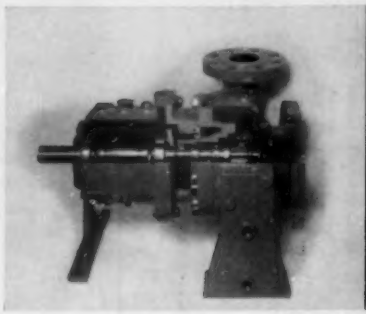
This simple, completely enclosed system ends vapor hazard, involved pipes and controls, and the need for constant monitoring. The inert glass protects product purity.

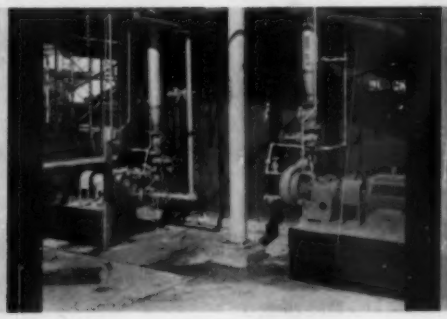
The ductile iron difference

To make ductile iron, magnesium is added to molten cast iron, changing the sharp, thin graphite flakes to spheroids. The spheroids have large areas of iron matrix between them, and since they have no sharp edges, the ductile iron has far greater strength than the original cast iron.

Ductile iron is so tough it can be used in many applications previously requiring cast steel.

It might pay you to look into this. Write us for information on ductile iron pumps or parts.





Pump with cold feet

The Goulds Model 3775, available in steel and any of the stainlesses, handles temperatures to 600° F because of its cooled support, bearing and seal chamber construction.

It is ideal for handling flammable or otherwise dangerous liquids, withstands thermal shock.

For information on this, or other products on this page, write Goulds Pumps, Inc., Dept. **PE-120**, Seneca Falls, N. Y.

Vicious viscous kept moving

Over 100 Goulds pumps do a wide variety of pumping jobs at Marathon Southern Corporation.

Among them are two tough 3715's. These keep abrasive, viscous black liquor moving. Each handles 200 gpm to a head of 65 ft. Stainless steel 316 construction resists the bite of hot, abrasive liquor.

Choose construction materials best suited for you when you get the Model 3715. Write for Bulletin 725.4 which lists available materials.

Now... circulate with Hastelloy "C"

If you need a small pump in a hurry to circulate or transfer clear corrosives—we can supply it right off the shelf.

Hastelloy* "C," a highly corrosion-resistant nickel-chrome-molybdenum alloy, is now available on our Model 3604. This ¾" centrifugal pump with big-pump stamina is built for 'round-the-clock service in chemical process work, pilot plant or laboratory.

Drop us a line and we will send you a bulletin with performance chart and other information.

*Trademark of the Haynes-Stellite Division of Union Carbide Corp.

GOULDS PUMPS

For more facts circle 511 on Reply Card

How to starve a scrap pile* at its source

* and all it represents

(DAMAGED TOOLS, RUINED MACHINES, REJECTS, WASTED LUBRICANTS, UNSCHEDULED DOWNTIME . . .)

TEXACO

Start a "STOP LOSS" program

Bearings ruined before their time by improper lubrication
Downtime caused by a man with the wrong grease gun
Lubricants wasted by over-lubrication
Damaged tools — burned and cratered by using the wrong type of cutting oil
Rejects from faulty cutting and grinding

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

Texaco's "Stop Loss" program has been developed for progressive managers in production, maintenance, purchasing, engineering and accounting who wish to apply new methods to control costs and add to profits.

The program has two purposes: (1) to demonstrate how organization of lubrication practices can be used to control costs resulting from product rejects, downtime, machine repair, excessive inventory, and (2) to provide specific instruction material to help plant groups find out where and how they can use Organized Lubrication to control costs in their own operations.

Lubrication is common to almost all plant functions. So don't be surprised when the "Stop Loss" program reveals ways to save in many places!

TURN PAGE FOR WHY

Expect tangible results!

HERE'S WHY AND WHERE:

In 1959, hundreds of plants organized their lubrication practices to reduce costs.

Their managements had recognized this fact: *Lubrication is no longer just a routine operating procedure. It is a key factor in controlling costs and, as such, rightly becomes a management function.*

This doesn't mean that management must put on overalls and grab a grease gun. But when management recognizes the dollars-and-cents significance of Organized Lubrication, they have made the first step toward reduced costs throughout the plant.

The Texaco Organized Lubrication Plan studies your lubrication methods in terms of long-range savings in production, equipment life, manhour utilization and inventory. A re-evaluation in terms of Organized Lubrication usually reveals how immediate savings can be made and continued.

Texaco has developed techniques and experience to make this new concept operative. They are offered to you, with the understanding that any Organized Lubrication program depends for success on those who adopt it and apply it.

Here's the help you need to starve YOUR scrap pile

Here are the parts of the Texaco Organized Lubrication Plan available to interested plant groups:

1. "Stop Loss with Organized Lubrication," a new 25-minute color and sound film created to show the opportunities for cost control through "Organized Lubrication."

2. A film "package" for plant departments. This consists of movies on cutting oils, greases, hydraulic oils, etc., that may be selected for showing after seeing the "Stop Loss" film.

3. Coordinated booklets on the film subjects and others to be used as guides in specific areas.

4. A Texaco Lubrication Control System to take the guesswork out of your lubrication scheduling. This simple system costs almost nothing to install, yet can save up to 15 per cent of your maintenance costs.

We can promise you that a modern Texaco Organized Lubrication Program will produce a package of economies in your plant. Texaco Inc., 135 E. 42nd St., N. Y. 17, N. Y.

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TEXACO INC.

135 East 42nd Street

New York 17, N. Y.

DEPT. E-151

This is your ticket to see Texaco's vital new movie "STOP LOSS"

Sign and mail it today!

TEXACO

Look for the label that assures weather resistance... high strength...pleasing appearance

This label on a glass-fiber reinforced panel is your assurance of *unmatched weatherability*. It appears only on panels made with PARAPLEX P-444 acrylic-polyester resin. Extensive laboratory and field tests have proved that the proper combination of acrylic and polyester resins produces the *best* weather resistance in reinforced panels. This combination is found only in PARAPLEX P-444, made by Rohm & Haas. The resin also imparts pleasing appearance, high strength, excellent light transmission, and ease of installation. Write for the names of panel manufacturers who use PARAPLEX P-444.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

PARAPLEX *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*

PARAPLEX P-444

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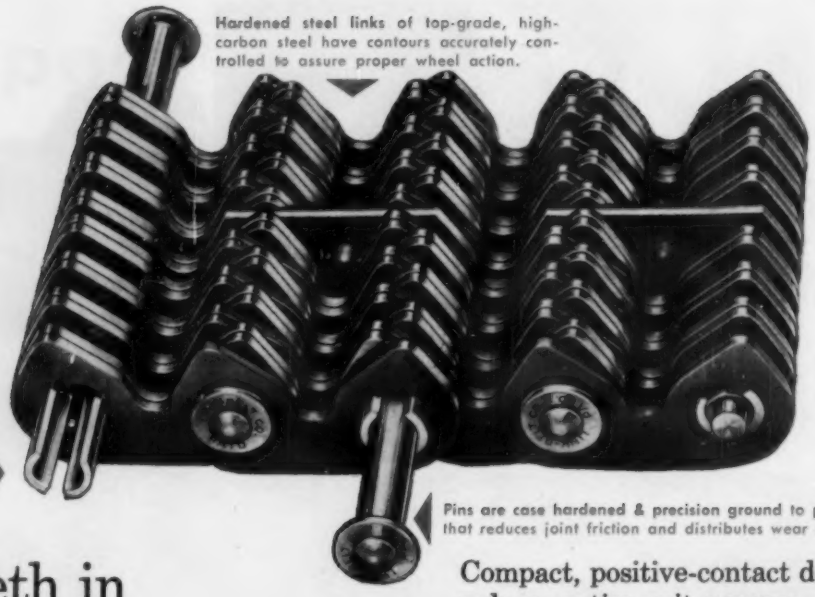
DEPT. E-151



Hardened steel links of top-grade, high-carbon steel have contours accurately controlled to assure proper wheel action.

Bushings of specially selected steel are case hardened to take joint wear and prevent elongation of link hole.

Pins are case hardened & precision ground to permit free rotation that reduces joint friction and distributes wear over entire surface.

The teeth in Link-Belt silent chain put the bite on drive costs

Compact, positive-contact design reduces entire unit expense

There are big savings to be found by switching to modern, versatile Link-Belt silent chain drives. Smooth, positive engagement prevents slippage, eliminating wasted horsepower. Long life—continuous operation with minimum maintenance for many years is common—keeps production costs down.

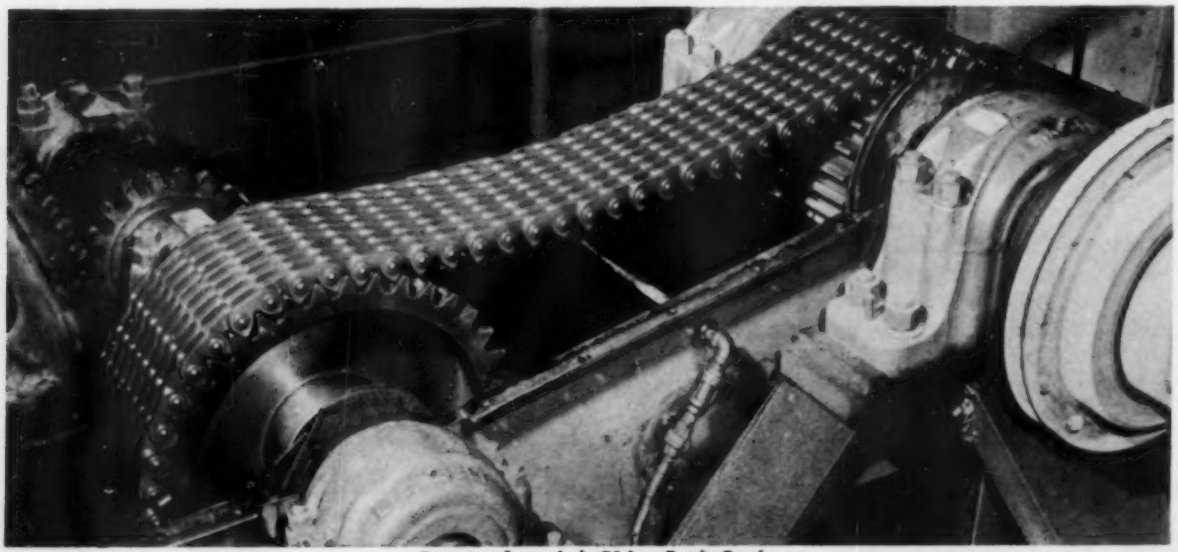
Now consider these additional advantages: dependable operation under extremes of temperature and humidity; easy assembly in tight spaces, permitting built-in drives, compact housings; space saving and efficiency on extremely short centers at ratios as high as 10-to-1.

Link-Belt silent chain is available in a full range of types and sizes for either large or fractional-horsepower drives. For full details, call your nearby Link-Belt office or authorized stock-carrying distributor. Look under CHAINS in the yellow pages of your phone book. Ask for Book 2425.

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15,440



For more facts circle 514 on Reply Card

BULLETINS just released and of immediate plant interest

TOOLS AND WELDING

Power Clamping Tools—Air-hydraulic clamping tools for all types of machine shop operations are featured in 16-pp Condensed Catalog 724. Typical applications are illustrated and detailed specifications included. Wilton Tool Mfg. Co., Inc.

▲ For a copy, circle 101 on Post Card

Planned Retooling—How a planned annual retooling program can increase output of screw driving, grinding, nut-running, drilling, and similar production operations is detailed in 28-pp Form 5250A. Offers basic formulas for computing dividend on payroll possible; lists typical figures for tool costs, pay rates, numbers of workmen and other data; and includes a handy computer for rapid calculation. Ingersoll-Rand Co.

▲ For a copy, circle 102 on Post Card

Multi-Operator Welding—Advantages of multi-operator welding systems which give up to 40 arcs from a single power source are detailed in 8-pp Bulletin MW-259. Principles of multi-operator welding are covered and method of calculating number or arcs available from power source outlined. A. O. Smith Corp.

▲ For a copy, circle 103 on Post Card

Welding Stainless Steels—This 24-pp bulletin is designed to function as a general reference guide on stainless steel welding. Practical procedures for welding and types of electrodes and wires available are covered, and information on specific effects of alloying elements in stainless steels and high strength heat resisting alloys is included. The McKay Co.

▲ For a copy, circle 104 on Post Card

Stainless Electrodes—This 6-pp folder contains a chart on chemical and physical specifications of stainless steel electrodes. Includes information on procedures to follow for best results in welding stainless steel, as well as principal properties as welded, color codes, and chemical specifications as welded for principle alloying elements. The McKay Co.

▲ For a copy, circle 105 on Post Card

PIPING AND VALVES

Clay Pipe and Fittings—Illustrated and described in 40-pp Bulletin E-360-53 is standard strength, extra strength, perforated, and double-length vitrified clay pipe, clay pipe with plastisol double-ball joint, clay fittings and other clay products. Tables of sizes and dimensions are included. The Evans Pipe Co.

▲ For a copy, circle 106 on Post Card

Piping Flexibility Analysis—This 12-pp bulletin describes a computer service for piping flexibility analysis. Step-by-step report on the analysis of a three-anchor and two-anchor system outlined. The Service Bureau Corp.

▲ For a copy, circle 107 on Post Card

Pipe Fitters Manual—Information expected to be at the finger tips of pipe fitters and pipe welders is concentrated into this 72-pp manual. Text, tables and illustrations in the pocket-size handbook give important mathematical, physical, chemical and metallurgical data and related design, layout and mechanical information. Tube Turns Div., Chemetron Corp.

▲ For a copy, circle 108 on Post Card

Industrial Vent Pipe—Advantages and properties of Transite industrial vent pipe are detailed in 20-pp Bulletin TR-237A. Engineering data and dimensions are tabulated, couplings and fittings are illustrated, and data on jointing compounds, fan connections included. Johns-Manville.

▲ For a copy, circle 109 on Post Card

For Fire Lines—Advantages of asbestos-cement Transite pipe for fire protection systems in industrial plants are detailed in 8-pp Bulletin TR-253A. Performance characteristics are described and typical arrangement of plant fire protection system included, along with design and specification data. Johns-Manville Corp.

▲ For a copy, circle 110 on Post Card

Non-Lubricated Plug Valves—Features and advantages of Sleeveline non-lubricated plug valves are outlined in 16-pp Bulletin V-14. Includes list of parts and materials of construction, dimensional data and diagrams. The Duriron Co., Inc.

▲ For a copy, circle 111 on Post Card

Lubricated Plug Valves—Function and properties of lubricants and selection of lubricants for lubricated plug valves are fully covered in this 12-pp lubricating manual. General specifications and a lubricant selection chart are included. Walworth Co.

▲ For a copy, circle 112 on Post Card

Valve Lubricant Gun—Featured in this 6-pp bulletin is a portable air-operated lubricating gun for large scale valve lubrication. Operating instructions, care and maintenance are covered. Rockwell Mfg. Co.

▲ For a copy, circle 113 on Post Card

Thermal Insulation—This master specification for thermal insulation (about 28 pp), is designed as a reference guide to insulated ductwork, piping, insulated equipment, flexible duct insulation, rigid duct insulation, insulation for hot pipes, anti-sweat insulation, insulation for cold pipes and others. Modern trends to fire-retardant materials have been incorporated. Insul-Coustic Corp.

▲ For a copy, circle 114 on Post Card

PUMPS

Pump Manual—Engineering Manual EM-611 contains 42-pp of comprehensive data on pumps and pumping. Defines common pump terms, and includes friction loss data, capacity and volume equivalents, decimal equivalents, horsepower requirements, installation details, viscosity and specific gravity table, and other engineering data needed in pump selection. Marlow Pumps, Div., Bell & Gossett Co.

▲ For a copy, circle 115 on Post Card

Centrifugal Pumps—Multi-stage, opposed-impeller, centrifugal pumps to handle hot or cold water, hydrocarbons, chemicals, acids, condensates and similar liquids are featured in Bulletin 140. Included is a chart which graphically illustrates which components are interchangeable. Pacific Pumps, Inc.

▲ For a copy, circle 116 on Post Card

Versatile Pump—Six-pp Bulletin P10-B46 describes operation and applications of a clog-free torque-flow pump. Typical applications in sewage treatment, slurry handling, chemical processing, suction lift and air handling, and others are illustrated. Western Machinery Co.

▲ For a copy, circle 117 on Post Card

MECHANICAL POWER TRANSMISSION

Mechanical Power Transmission—Manufacturer's complete line of mechanical power transmission equipment is illustrated and described in 8-pp Bulletin 23103. Products covered include variable speed drives, conventional v-belt and Ultra-V belt drives, timing belt drives, flat belt pulleys, couplings. T. B. Wood's Sons Co.

▲ For a copy, circle 118 on Post Card

Shaft, Flange Mounted Drives—Design and construction advantages of shaft and flange mounted drives are detailed in 36-pp Bulletin 7100. Operation and selection information is included along with dimensional data and diagrams and photos of application possibilities. The Falk Corp.

▲ For a copy, circle 119 on Post Card

On pages 227-228 are two postage-free Reader Service Cards provided for your convenience in ordering these bulletins. You may also use the cards to order any literature mentioned in ads.

Cycloid Type Reduction—This 8-pp bulletin presents the Hi-Range reduction drive, based on the cycloid principle of speed reduction. Discusses high torque, compactness, wide reduction range and other advantages afforded, for standard and unusual requirements. Explains how the drive works; includes selection information, ratings, dimensions. Black Tool, Inc.

▲ For a copy, circle 120 on Post Card

Shaft Mounted Reducers—Features and advantages of a shaft-mounted rotating transmission are described in 8-pp Bulletin IR-60. Provides charts, tables, diagrams and cutaway drawings showing design and construction details. Airborne Accessories Corp.

▲ For a copy, circle 121 on Post Card

BULLETINS

(Begins on page 23)

Flexible Cushion Couplings—Two types of flexible cushion couplings, one for high speed, high torque applications and another for attachment to flywheels of internal combustion engines, are described in 20-pp Bulletin 901. Includes engineering data, photos, dimension drawings and selection tables. Dodge Mfg. Corp.

▲ For a copy, circle 122 on Post Card

Heavy Duty Couplings—Twelve-pp Catalog 70 contains engineering, application, capacity and dimensional data on dihederal spindle shaft couplings for use on mills and allied equipment throughout the ferrous and non-ferrous metal, paper, rubber, chemical, food and other industries. Ajax Flexible Coupling Co., Inc.

▲ For a copy, circle 123 on Post Card

Cast-Tooth Sprockets—Stock sizes of cast-tooth sprockets are listed in 12-pp Book 2867. Lists types and sizes of cast-tooth sprockets, including arm center, plate center, segmental and split rim sprockets and traction wheels, and includes detailed selection tables. Link-Belt Co.

▲ For a copy, circle 124 on Post Card

FANS, VENTILATING

Space Saving Fans—Features and advantages of an airfoil centrifugal fan which boasts the high efficiency characteristics of a centrifugal fan yet requires less than half the installed space are detailed in 14-pp Catalog 1125. Illustrated with photos, construction and installation diagrams, it contains performance curves and selection tables. Sturtevant Div., Westinghouse Electric Corp.

▲ For a copy, circle 126 on Post Card

Roof Ventilators—Solid plastic roof ventilators for removing corrosive fumes are described in Engineering Data Sheet E-7801. Specifications and dimensional data are included. Heil Process Equipment Corp.

▲ For a copy, circle 127 on Post Card

INSTRUMENTS, CONTROLS

Electric, Electronic Controls—Applications of electric and electronic controls in commercial and industrial air conditioning installations are described in 18-pp Bulletin F-9538. Covers basic principles of electronic control and makes comparisons between electronic and pneumatic controls, illustrated with photos and diagrams. Barber-Colman Co.

▲ For a copy, circle 128 on Post Card

Static Control—Eight-pp Bulletin GEA-6578A describes features and applications of static control for machinery and process control without moving parts. Basic logic elements are covered, components described, and installation details included. General Electric Co.

▲ For a copy, circle 129 on Post Card

Transistorized Controls—Transistor circuits and thermistor sensing elements are among features of temperature controls described in 8-pp Bulletin MC-190. Detailed specifications and sketches of application arrangements are included. Fenwal Inc.

▲ For a copy, circle 130 on Post Card

Electronic Controls—Latest developments in high speed, ultra sensitive and impulse actuated controls, tubeless photoelectric controls, safety controls, timing controls, controls with built-in sensing heads, remote sensing head and with miniature remote sensing heads, plug-in mounted controls and others are featured in 24-pp Catalog 60. Application diagrams are included. Autotron, Inc.

▲ For a copy, circle 131 on Post Card

Infrared Pyrometers—Industrial infrared radiation pyrometers for permanent installation or portable use are described in Technical Bulletin TB 1372. Detailed specifications are included. Servo Corp. of America.

▲ For a copy, circle 132 on Post Card

Thermal Systems—Twelve-pp Specification Sheet S-690-1a covers bulbs, tubing and fittings for filled system thermometers. Gives detailed information on sizes, lengths, materials for bulbs and tubings of gas, mercury and vapor-actuated thermal systems, as well as a vibration-resistant gas-actuated thermal system using miniature bulbs. Minneapolis-Honeywell Regulator Co.

▲ For a copy, circle 133 on Post Card

Receiver Gages—Eight-pp Catalog 520 describes dial indicating receiver gages designed to indicate values transmitted by pneumatic signal from remote locations. Gives specifications and contains information on materials, dials, ranges, case styles and sizes. United States Gauge. Div., American Machine & Metals, Inc.

▲ For a copy, circle 134 on Post Card

Open Hearth Control Systems—Adaptation of automatic control systems to open hearth furnaces is described in case history form in 16-pp Bulletin MSA-189. Graphically demonstrates how automatic controls can be applied to older furnaces and lists five steps necessary for full automation. Hagan Chemicals & Controls, Inc.

▲ For a copy, circle 135 on Post Card

On-Stream Analysis—Principles upon which continuous, non-contacting measurements of fluids in pipes is achieved are discussed in 12-pp Bulletin CA-860. Describes composition analysis systems using radioisotopes and includes photos and drawings, and detailed application data. Industrial Nucleonics Corp.

▲ For a copy, circle 136 on Post Card

Armored Multitube—Detailed information on spirally cabled tubes for instrument and control systems is presented in 12-pp Bulletin 960. Various types of tubing, the protective interlocked armor, types of corrosion-resistant sheaths, as well as instructions for installations, included. Crescent Insulated Wire & Cable Co., Inc.

▲ For a copy, circle 138 on Post Card

Postage Free Cards for ordering bulletins are on pages 227-228. Be sure to include your name, job title, and company even if you want bulletins mailed to your home address.

LIGHTING, COMMUNICATION

Portable Lighting—Advantages of portable industrial lighting are detailed in 12-pp Bulletin B76. Shows how lamps, extensions, sockets and other unitized assemblies can be connected to form an economical lighting system and includes selector chart. Joy Mfg. Co.

▲ For a copy, circle 139 on Post Card

For Control, Communication—Featured in 36-pp Bulletin S-100 C1 is a line of control, communication and protection equipment for industrial and commercial buildings. Includes detailed specifications on annunciators, bells and buzzers, fire alarm equipment, push buttons and transformers. Edwards Co., Inc.

▲ For a copy, circle 140 on Post Card

Industrial Sound Systems—Featured in this product bulletin are industrial sound systems and components for a variety of industrial and other installations. Covers loudspeaker columns, amplifiers, preamplifiers, microphones, intercom systems, delayed sound equipment and inductive paging. The North American Philips Co.

▲ For a copy circle 141 on Post Card

MATERIALS HANDLING

Horizontal Conveyors—Five types of horizontal power conveyors are described in 8-pp Bulletin 19-1200. Product and installation photos show conveyor in wheel and roller models, live-roller conveyors, belt-on-roller conveyors, and table conveyors. The Rapids-Standard Co., Inc.

▲ For a copy, circle 142 on Post Card

Cradle Idler—Detailed information on a cradle idler and belt conveyor for handling all types of materials is presented in 16-pp Bulletin 660. Photos, dimensional drawings and capacity tables are included. The McNally Pittsburg Mfg. Corp.

▲ For a copy, circle 143 on Post Card

Belting Catalog—Specifications and other information on conveyor, elevator and transmission belting are presented in this 36-pp product bulletin. Tables giving belt weights, gages, fabrics, and belt recommendations are included. Boston Woven Hose & Rubber Div., American Biltrite Rubber Co.

▲ For a copy, circle 144 on Post Card

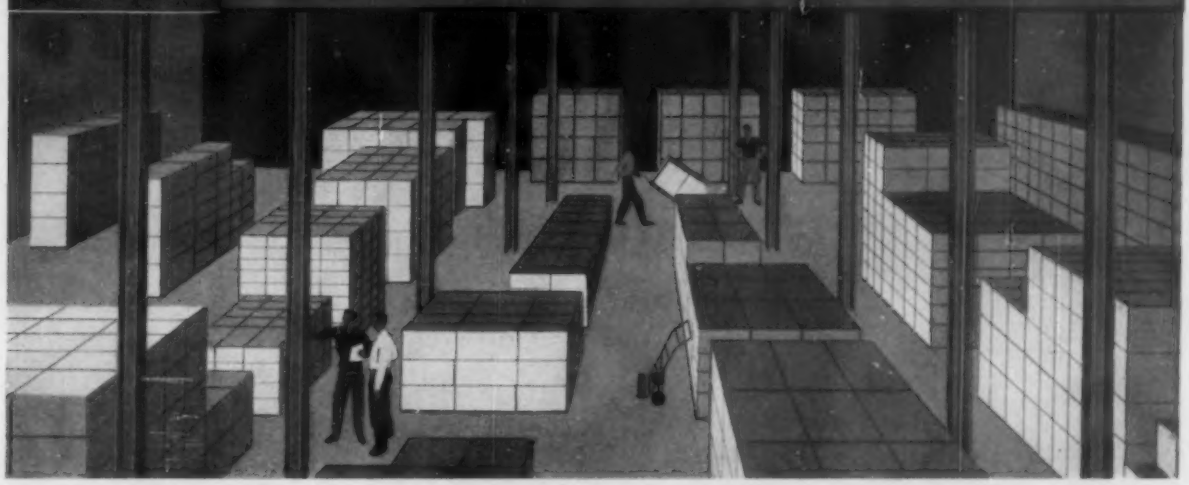
Equipment Leasing—Advantages of renting materials handling equipment are detailed in this 16-pp illustrated bulletin. A chart for comparing cost of ownership with rental plan is included covering such factors as overhead, equipment obsolescence and other expenses. Clark Equipment Co.

▲ For a copy, circle 145 on Post Card

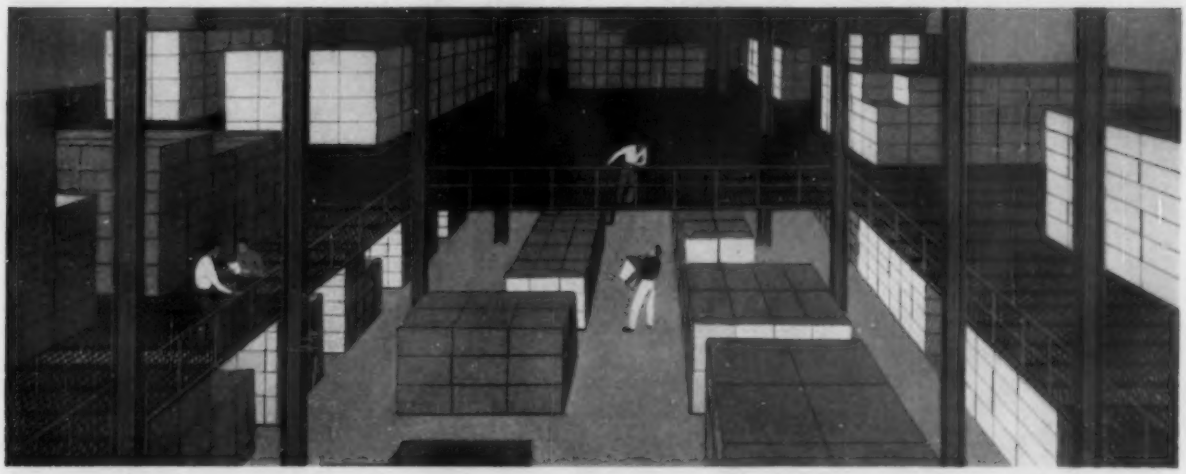
(More Bulletins on page 229)

Wheeling

EXPANDED METAL GRATING BY WHEELING

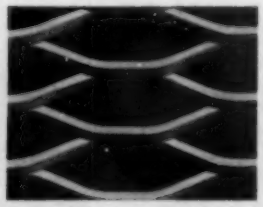


Double floor space...



the easy way!

Want to double warehouse floor space *without the cost and trouble* of adding more heating ducts, lighting and fire sprinklers? Then install a mezzanine of Wheeling Expanded Metal Grating. This rugged steel flooring has hundreds of openings that permit the free passage of heat, light and water . . . enable your present service facilities to take care of *both* the mezzanine and main floor.



More than that, Wheeling Expanded Metal is cold drawn for extra strength . . . is actually stronger than the steel from which it's made. So you can cut your costs still further by using lighter supporting structures.

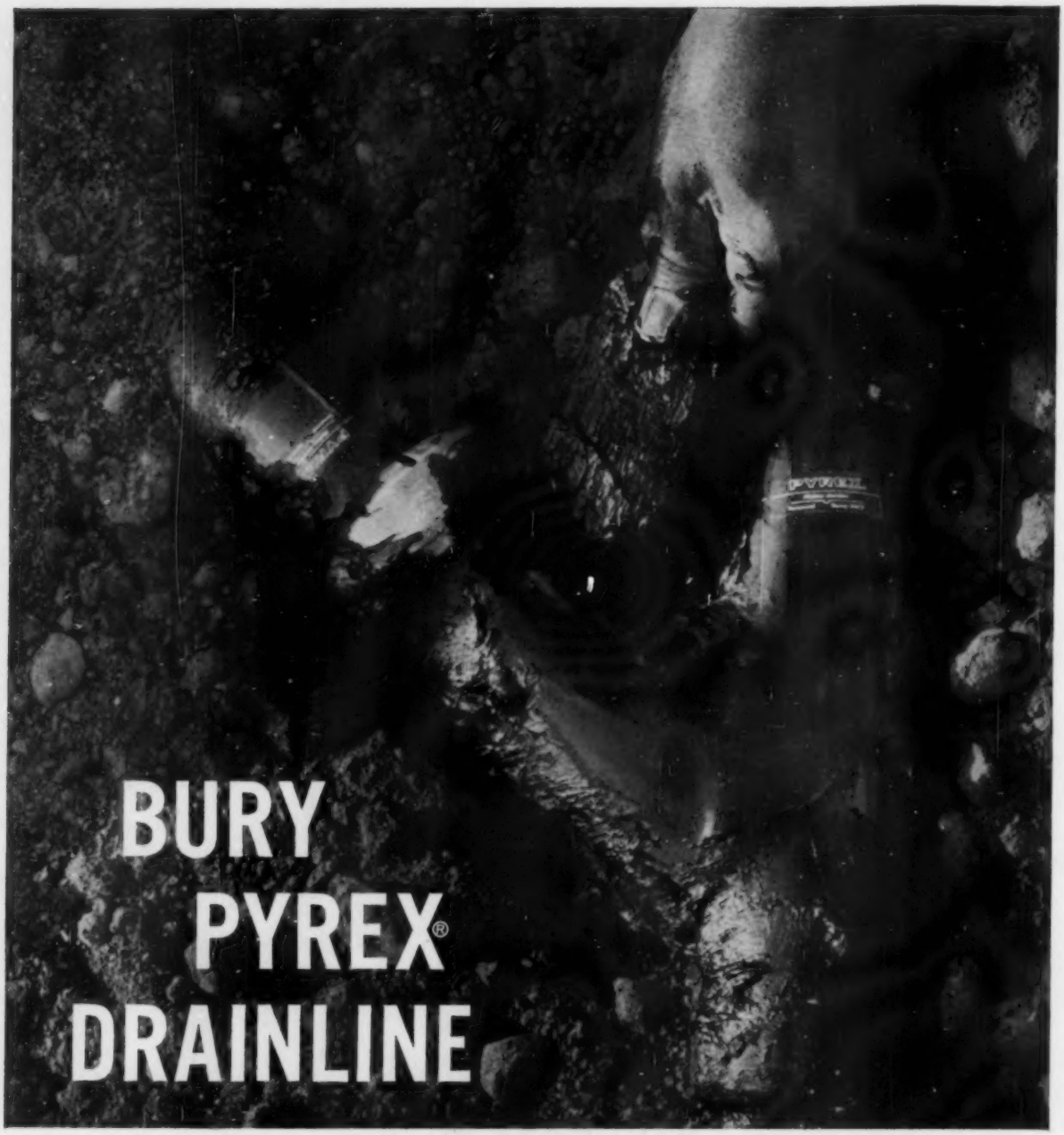
Ask your Wheeling man for complete details on how you can use Wheeling Expanded Metal to best advantage in your plant. Or write today to Wheeling Corrugating Company, Wheeling, West Virginia.

Steel

WHEELING CORRUGATING COMPANY · IT'S WHEELING STEEL!

Immediate delivery on all stocked items from these warehouses: *Boston, Buffalo, Chicago, Columbus, Detroit, Kansas City, Louisville, Minneapolis, New Orleans, New York, Philadelphia, Richmond, St. Louis.* Sales Offices: *Atlanta, Houston.*

For more facts circle 515 on Reply Card



...YOU NEED NEVER WORRY ABOUT CORROSION OR LEAKAGE

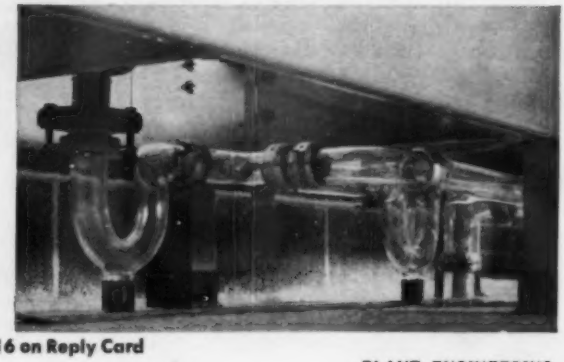
Ask any bench chemist and he'll tell you of the matchless corrosion resistance of the PYREX labware he uses daily.

Why not have the same corrosion resistance in laboratory drainlines or waste lines? A PYREX drainline will handle any acid material except massive quantities of hydrofluoric acid. Even buried in the ground, it resists rust, rot, and electrolytic corrosion.

NEW BULLETIN TELLS ALL. PE-30 explains all about the drainline and the new one-nut joint (patent pending) which makes it the least expensive drainline you can install. Write 1012 Crystal Street, Corning, N. Y.

CORNING GLASS WORKS
CORNING MEANS RESEARCH IN GLASS

200 feet of PYREX drainline are buried underneath concrete at Frontier Chemical's new research center in Wichita, Kan. All standard fittings are available.



For more facts circle 516 on Reply Card

POWELL PRESSURE SEAL VALVES

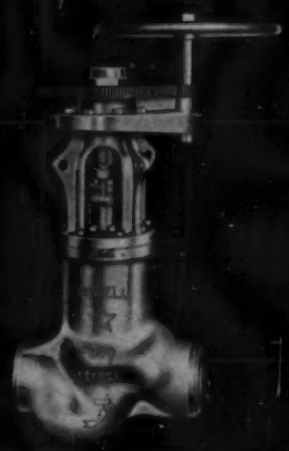


Fig. 19084—Steel Pressure Seal Non-Return Globe Valve for 900 pounds W.P. Spur Gear operated. Can also be furnished with bevel gears if required.

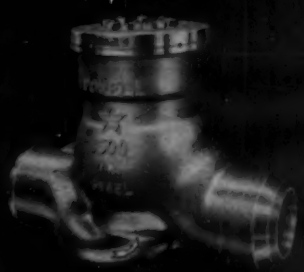


Fig. 11365—Steel Pressure Seal Horizontal Lift Check Valve for 1500 pounds W.P. Powell streamline design assures maximum flow through with minimum pressure drop and turbulence.

Fig. 11313—Steel Pressure Seal Gate Valve, with By-pass, for 1500 pounds W.P. By-pass valve is Powell Integral Bonnet Angle Valve, Fig. 1333A, for 1500 pounds pressure.

Performance makes the world of difference

Keeping modern industry's constantly mounting temperatures and pressures in check demands rugged, dependable controls. Powell Pressure Seal Valves have proved equal to this task in more than 10,000 installations the world over. Precision-built, precision-tested, leak-proof, with many exclusive design and construction features—Powell Pressure Seal Valves are available in gate, globe, angle and check patterns for 600 to 2500 W.P., and special working pressures upon request. Many are in distributor stock or factory stock for quick delivery.

If you have a flow-control problem involving high temperatures and high pressures, your nearest Powell distributor has the solution. Talk to him. Or call us direct for complete information and illustrated literature.

Powell . . . world's largest family of valves

THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

For more facts circle 517 on Reply Card

HOW PUROLATOR HELPS SOLVE THESE FOUR COMMON IN-PLANT FILTRATION PROBLEMS

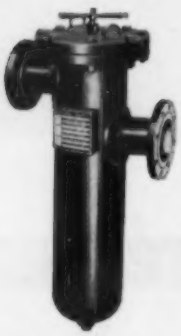
Proper filtration means reduced wear, longer life and increased efficiency for most types of machinery. It also means higher quality manufactured products because of contaminate-free process fluids.

As the world's largest, most-experienced maker of filters, Purolator has over 2,000 standard filter units available. Standard Purolator filters solve these filtration problems. Chances are, they will also solve yours. If not, Purolator will design — and make — filters that will. See your nearby Purolator distributor, or write: Purolator Products Inc., Rahway, New Jersey.

PROBLEM: Contamination of Bulk Fluids and Semi-Fluids Before Packaging. Despite rigid precautions, various contaminates can enter bulk fluids during processing. These contaminates may be: oxides from pipe corrosion; water from evaporation in storage tanks; tiny metal chips from machinery; or foreign matter picked up from the atmosphere.

SOLUTION: Purolator Model G-141J Metal Edge Filter is ideal for filtering most bulk fluids just before packaging. These fluids might include: inks, varnishes, food products, greases; process fluids, or lube and fuel oils.

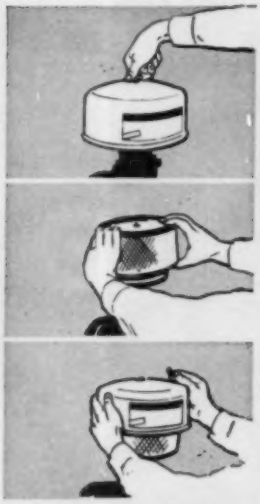
The G-141J's filter element is permanent . . . made of precisely-spaced metal ribbon wound into cylinder form. Capacity ranges from 6 to 200 GPM. Filtration . . . from 25 to 500 microns. Installation can be made on either pressure or suction side of pump. If desired, filter is also available in stainless steel.



Continuous, Permanent Filtration. Cleaning the G-141J is simple, too. No need to disassemble the unit or stop the flow of fluid. Turning handle rotates metal edge filter unit against fixed knife-blade which shears off waste. This is periodically removed through plug at bottom. If service warrants, filter element can be rotated continuously by motor drive.

PROBLEM: Air-Filter Maintenance. Removing, washing and re-oiling ordinary oil-bath type air filters is a time-consuming (and expensive) chore. What's more — this type of unit is relatively inefficient. Clogs easily and then lets abrasive-laden air into the engine.

SOLUTION: Purolator Micronic filter elements can be replaced in seconds. Special accordion pleating means 9-14 feet of filter area — 10 times that of most competitors. Controlled porosity filters out particles as small as .000039 of an inch. Models up to 1,000 CFM available.



Service in Seconds. Here's all you do to service a typical Purolator Dry Type Micronic Air Filter:

1. Loosen wing nut. Remove cover and dirty refill.
2. Replace with a new Purolator Micronic refill.
3. Replace cover and tighten wing nut.

Purolator refills are inexpensive. However, filter element life can be extended by cleaning. This is done by applying reverse flow of low pressure air through element.

PROBLEM: Incomplete Filtration of Lubricating Oil. Various bleeder, bypass, shunt and similar partial flow systems often used on machine tools and large engines can cause damaged parts and excessive wear because contaminates are permitted to pass into the engine.

SOLUTION: A Purolator Micronic Filter of correct size can handle full lubricating oil flow for even the largest engines. The protection this kind of filter gives the engine exceeds anything a partial flow arrangement could accomplish.

Full-flow lube oil filtration. Pictured above is a typical Purolator Micronic Filter, Series P-32.

PROBLEM: Diverse Filter Requirements of Hydraulic Circuits. Without proper filtration, most hydraulic circuits would soon break down. Yet even a small plant has many different hydraulic circuits — each one requiring a specific type of filter.

SOLUTION: Purolator's complete line of filters for hydraulic systems is the most comprehensive of its kind. Models include: suction strainers to protect pumps; high-pressure filters to protect delicate control valves; and low-pressure filters for return circuits.

Complete line of filters for all hydraulic circuits. Here are just a few standard units. Filter media include: Micronic, metal edge and wire cloth.

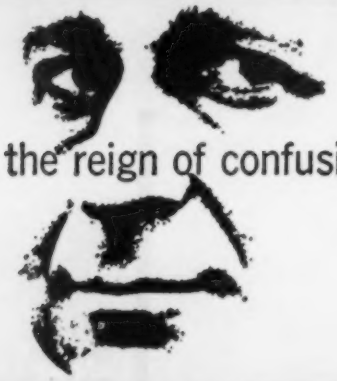
Filtration For Every Known Fluid

PUROLATOR

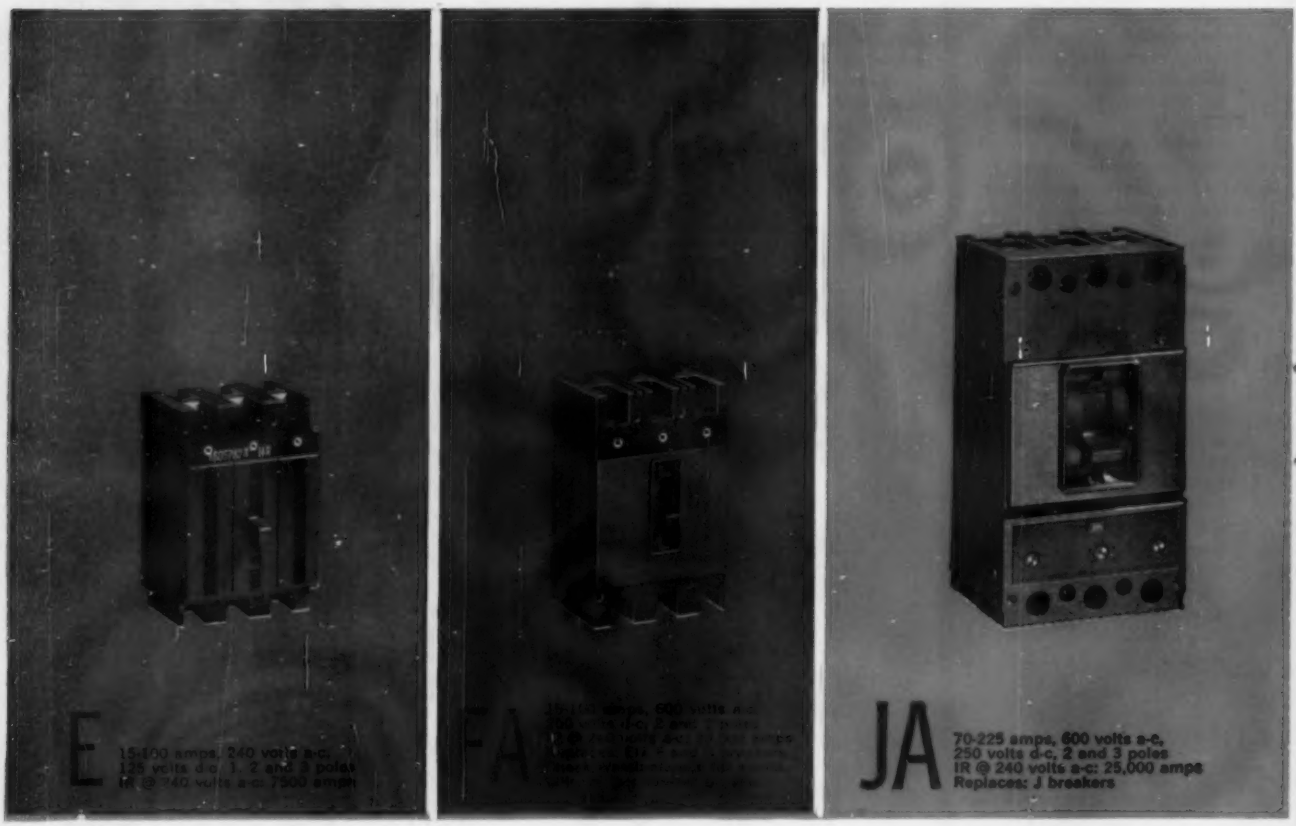
PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

For more facts circle 518 on Reply Card



the reign of confusion is over


E
15-100 amps, 240 volts a-c,
125 volts d-c, 1, 2 and 3 poles
IR @ 240 volts a-c: 7500 amps
FA
JA
70-225 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 25,000 amps
Replaces: J breakers

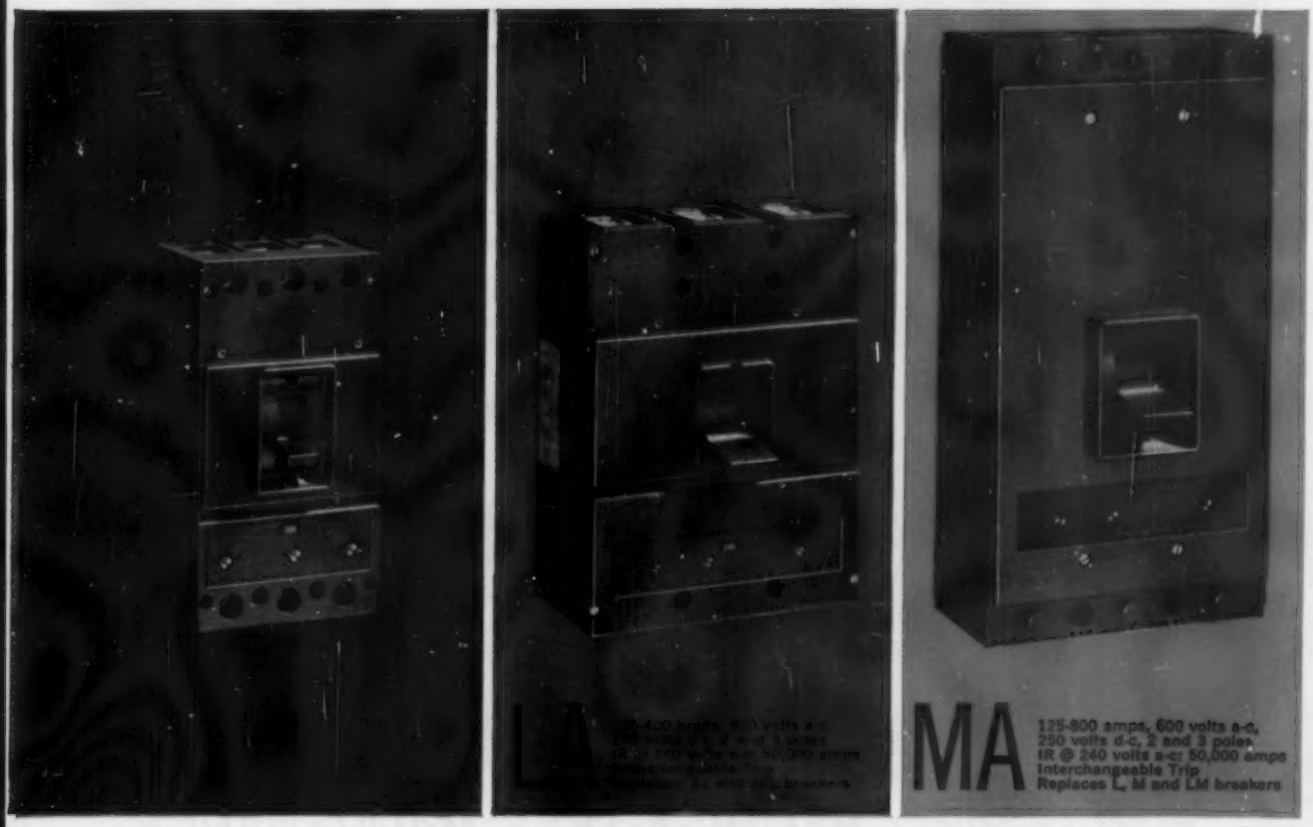
Newly Designed Westinghouse Breakers

The confusing assortment of letters that tagged the breakers of the past should trouble you no more. The reason: clear-cut designations for the new smaller size Westinghouse breaker family.

New designations mean that specifying is simple . . . identifying each breaker is easy.

High interrupting ratings in smaller frame sizes mean you save as much as 50% on space.

The Westinghouse design means that you have extra-long life, unfailing reliability.


MA
125-800 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 50,000 amps
Interchangeable Trip
Replaces L, M and LM breakers

J-80320

Are Simple to Specify/Easy to Identify

Any way you look at it, the NEW Westinghouse breakers are the ones you'll want to use.

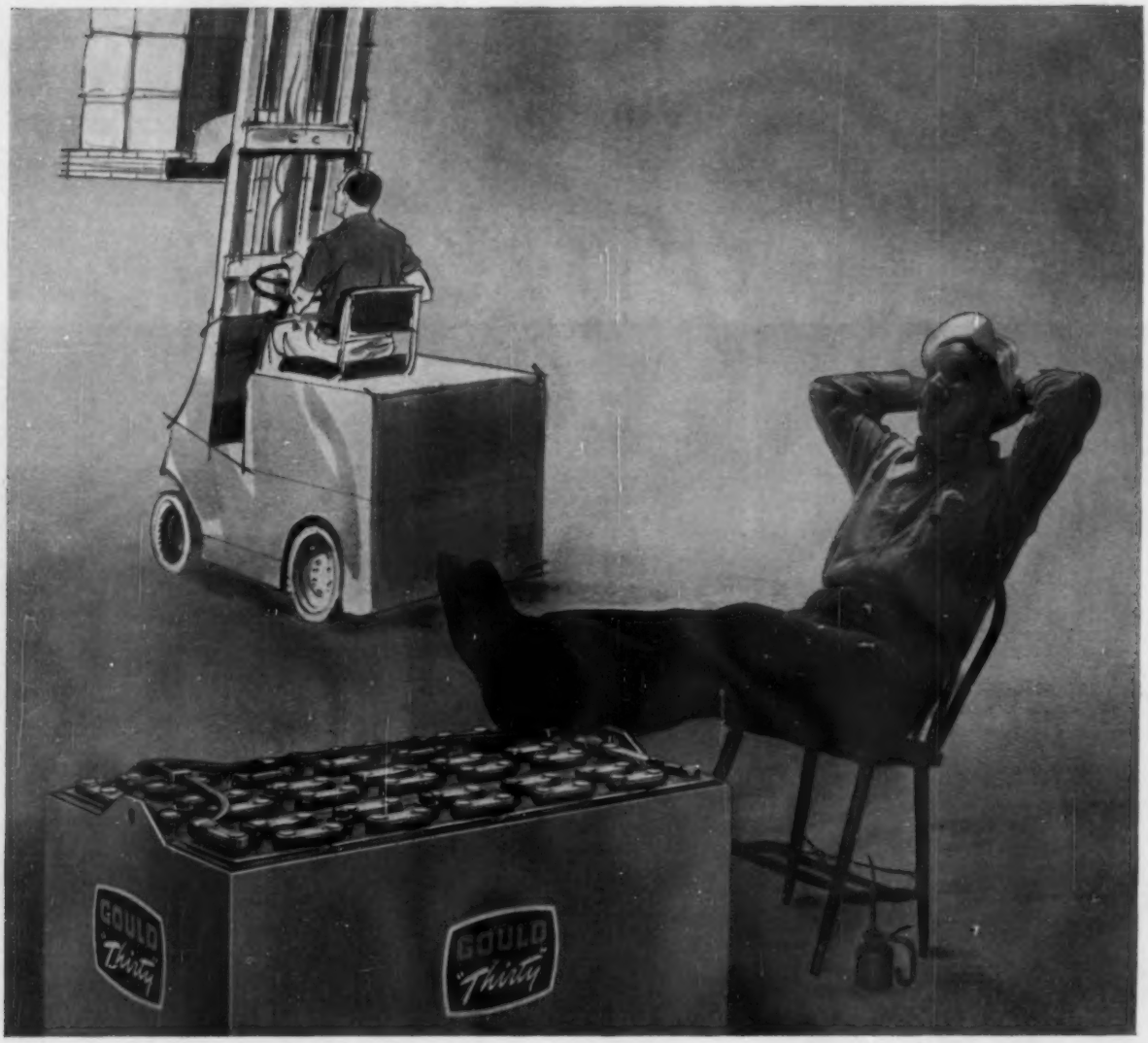
More information? Contact your nearest Westinghouse representative, Westinghouse distributor, your independent panelboard builder . . . or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

For a large, plastic laminated wall chart of the new breaker line, write Westinghouse.

All Westinghouse AB breakers meet or exceed NEMA and UL specifications.

You can be sure . . . if it's Westinghouse

For more facts circle 519 on Reply Card



Electric Trucks REQUIRE LESS MAINTENANCE

Simpler construction and fewer moving parts, combined with the vibrationless, rotary motion of the electric motors, make minimum repair and replacement on battery-powered electric trucks self-evident.

Add less maintenance to a convincing list of other benefits—lower operating costs, maneuverability, clean, quiet and safe operation—and you can easily see the main reason why users indicate a preference for battery-powered electric trucks for modern, efficient materials-handling jobs of all types.

Electric truck users generally agree on one other point, too—Gould Batteries for longer life. With the new Silconic Plate, Gould Batteries offer up to 25% longer life.

Join the list of users who prefer this ideal combination of electric trucks and Gould Batteries. For more information, write or call your local Gould representative. Ask for booklet "Why We Use Battery-Electric Industrial Trucks." Gould-National Batteries, Inc., Trenton 7, N. J. In Canada, write to Gould-National Batteries of Canada, Ltd., 1819 Yonge Street, Toronto, Ont.

More Power to you from **GOULD**

For more facts circle 520 on Reply Card

WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** Paints

Safety coding, through the proper marking of plant hazards and protective equipment, plays an important role in industrial accident prevention programs. You have it, or *should* have it, in your plant!

To help you make sure you *are* making the most of paint to safeguard the lives of your plant personnel, why not call in your Barreled Sunlight representative for free "Color Survey" Service. This personal, in-plant survey by a trained color expert includes formal recommendations for a complete, practical painting plan tailored to your exact plant requirements.

Take this first step toward the economy and effectiveness of a planned painting program now. Your inquiry does not obligate you in any way . . . it is your indication of further interest.

BARRELED SUNLIGHT PAINT COMPANY
125-L Georgia Avenue, Providence 5, Rhode Island

I want to learn more about your Free "Color Survey" Service.

☐ Please have your representative call to arrange an appointment at my convenience.

☐ Also, please send me your "Quick Reference Guide" to Barreled Sunlight Paints, plus your booklet, "How To Reduce Painting Costs".

Name.....

Title.....

Company.....

City.....*Zone*.....*State*.....

For more facts circle 521 on Reply Card

"THIS LUBRICANT SAVES 7 TIMES ITS COST IN PRODUCING SHOES"

says: WOLVERINE
Shoe and Tanning Corp.

"We use LUBRIPLATE No. 100 for lubricating the chains that drive the paddle wheels which turn hides immersed in solution. The solution is sometimes acid, sometimes caustic. Until we tried LUBRIPLATE, chain life was only about one year. After a two year test, applying LUBRIPLATE to the chains every two weeks, it appears that for every dollar we invested in LUBRIPLATE, we have saved seven dollars in chains!"

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

For more facts circle 522 on Reply Card

BACKTALK AND FORETHOUGHTS

Edited by Marjorie E. Weissman

Case of the Missing Article

PLANT ENGINEERING:

"If at all possible, could you please supply me with one tear sheet of the 'Construction Cost Estimating' Part 11, inasmuch as I loaned out my copy to several individuals only to discover upon its being returned recently that Part 11 was missing.

"Upon investigating same, I was unable to determine what had happened to it, so if it isn't too great an imposition, would you please forward me this part, thereby enabling me to once again have the complete set." *J. W. Kostopolos, United Engineering and Foundry Co., Pittsburgh, Pa.*

■ It's no imposition and we are glad to replace the missing part. We would like to suggest that, for his own peace of mind, Mr. Kostopolos drop a hint or two among those borrowers, that reprints of the complete series on construction cost estimating are available at $1.50 each.—*Editors.*

Improved Steam Cleaning

PLANT ENGINEERING:

"In the August 1960 issue of the PLANT ENGINEERING magazine, there was an article on page 127 about an improved method of steam cleaning equipment with low pressure steam.

"We are interested in this process and would appreciate any information you can furnish. We would like to know the type of detergent and where it can be obtained as well as the name of the electric heating equipment and where it can be purchased." *D. E. McCahan, General Foreman, Maintenance, Plant 5, Allison Division, General Motors Corp., Indianapolis, Ind.*

■ Requests for more information about the specific equipment mentioned in our article have been forwarded to the manufacturer.—*Editors.*

Practical Pickling Plant

PLANT ENGINEERING:

"In the December, 1959 issue of PLANT ENGINEERING, there appeared an article entitled 'Inco's Pickling Building Features Functional Design.'

"Our factory is presently in the process of laying out and designing a building of similar application. The above article would indicate that Inco's solution is almost exactly what we are seeking. I would appreciate it very much if you could refer me to someone at Inco who might furnish more information on their structure. We would eventually be anxious to contact them personally along with the building contractors." *A. S. Marzo, Linde Co., Div. Union Carbide Corp., Tonawanda, N. Y.*

■ We are pleased to provide this information and have forwarded it to Mr. Marzo.—*Editors.*

Still Coming In

PLANT ENGINEERING:

"Please send me a Sylvania lighting calculator free. This is noted on page 119 of your September, 1960 issue.

"I look forward to getting your magazine each month as you publish many articles of interest to me." *William C. Reeves, District Engineer, Pet Milk Co., Salt Lake City, Utah.*

PLANT ENGINEERING:

"Received your magazine today and am very much interested in your article entitled 'How To Plan Industrial Lighting.'

"I plan to follow the balance of your articles and would like to receive your free lighting calculator to work out the problems.

"This is coming at a time when we are planning a change in our machine shop to add more light which we believe will aid us to reduce our scrap." *R. E. Swoverland, Plant Engineer, Copeland Refrigeration Corporation, Sidney, Ohio.*

PLANT ENGINEERING:

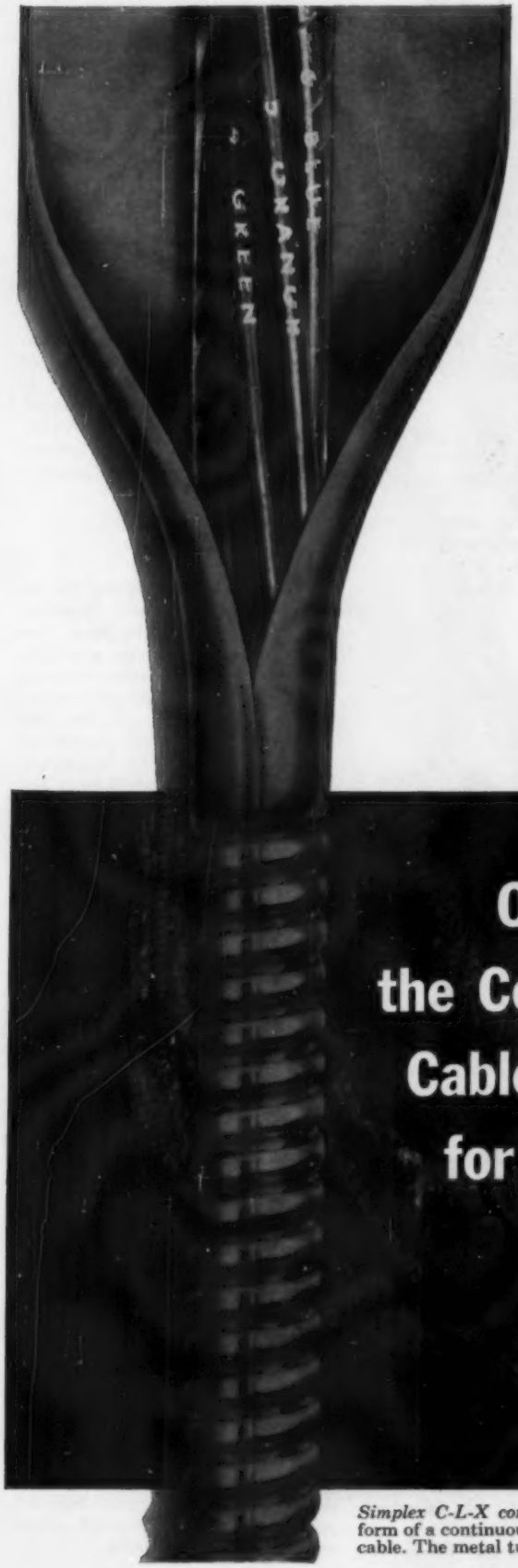
"Please send me one of the Sylvania lighting calculators described by Mr. Allphin in the article 'How To Plan Industrial Lighting,' which appeared in the September, 1960 issue of your magazine.

"We found this article particularly interesting since we are now faced with such a problem and look forward to the balance of this series. Perhaps the lighting calculator will be able to help us with future problems." *F. D. Wallace, Manufacturing Assistant to the General Manager, General American Transportation Corp., Compton, Calif.*

PLANT ENGINEERING:

"While reading the September issue of PLANT ENGINEERING, I ran across an interesting article entitled 'How To Plan Industrial Lighting' by Willard Allphin.

"Included in this article is the nota-



The cable you see here is *not* interlocked armor. It is Simplex' new C-L-X . . . the completely sealed cable system.

- Completely sealed against liquids and gases.
- Protected against mechanical damage by a continuous, corrugated metallic sheath.
- As pliable as unsheathed cable because of its corrugated design.
- Needs no separate duct or conduit in any environment.
- Nonferrous sheaths can be designed to function as grounds or shielding.

Simplex C-L-X is impervious to liquids and gases, is resistant to all forms of mechanical damage, and is as pliable as unsheathed cable.

Available with sheaths of steel, aluminum, copper or bronze, and with or without outer plastic jacketing, Simplex C-L-X provides the ideal solution for almost any installation, particularly those in which cable life is limited by severe ambient conditions.

Write today for illustrated brochure containing application and engineering information.

Simplex

WIRE & CABLE CO.

Cambridge, Mass. • Newington, N. H.

Only Simplex C-L-X . . . the Completely Sealed Cable System . . . is Built for Torturous Conditions Like This

Simplex C-L-X combines cable and duct in one integrated system. Metal, in the form of a continuous flat strip, is formed into a welded tube around the insulated cable. The metal tube is then corrugated to form Simplex C-L-X.

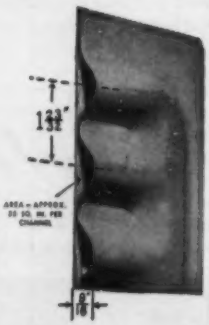
For more facts circle 523 on Reply Card

STOP USING PIPE COILS

DEAN® PANELCOIL
FOR HEATING—COOLING

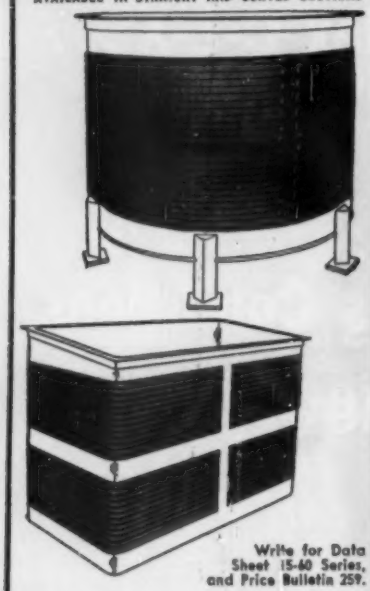
TAKES THE PLACE OF PIPE COILS

COSTS LESS
•
LIGHTER
•
LESS SPACE
•
FAST, UNIFORM HEAT TRANSFER



Dean Panelcoil is made by seam welding two sheets of metal together, one or both sheets being embossed to form the flow channels.

AVAILABLE IN STRAIGHT AND CURVED SECTIONS



Write for Data Sheet 15-60 Series, and Price Bulletin 259.

DEAN PRODUCTS, INC.
1047 Dean St., Brooklyn 38, N. Y.
STerling 9-5400
Backed by 25 Years of Panel Coil Manufacturing

For more facts circle 524 on Reply Card

BACKTALK—FORETHOUGHTS

tion of a lighting calculator. This calculator appears to answer many questions about lighting and I would appreciate your sending me one.

"In closing, I would like to express my appreciation of your publication and the many informative articles in each issue." *O. Zambon, Industrial Engineer, Univex Die Cast and Engineering Co., Dearborn, Mich.*

Industrial Lighting Clinic

PLANT ENGINEERING:

"Our co-sponsoring the Clinic on Industrial Lighting with PLANT ENGINEERING magazine in October, was a most successful event. All our contacts with you and Vern Kempf were most pleasant. The whole undertaking worked so smoothly that it seems now as though we had done this many times before.

"We had in excess of 100 people present.

"We look forward to another co-sponsored Clinic for Plant Engineers next fall." *Carl W. Zersen, Managing Director, Chicago Lighting Institute, Chicago, Ill.*

Revamping Maintenance Program

PLANT ENGINEERING:

"We are currently starting preliminary studies leading to a complete revision of our maintenance department methods and procedures. From time to time I have noted various articles in PLANT ENGINEERING covering maintenance scheduling, estimating, standards, record keeping, etc. We would appreciate receiving reprints of articles dealing with this over-all type of program and any other miscellaneous information on this subject which you might have available.

"Thank you for any help you might give us on this. We certainly feel PLANT ENGINEERING is the most valuable technical magazine which we receive." *Robert J. Schwade, Plant Engineering Supervisor, Bristol-Myers Products Division, Bristol-Myers Co., Hillside, N. J.*

Why Lamps Fail

PLANT ENGINEERING:

"Several years ago in PLANT ENGINEERING magazine, I understand that you wrote an article on the subject of lamps and particularly a discussion of the early failures and other difficulties inherent with cheap lamps.

"While I have not had the opportunity to see this article, I understand it is an excellent one and would appreciate very much your advising me as to whether or not reprints are available. If reprints are available, please let me have one copy so that I can check it through and determine what quantity I might need. I have in mind possibly sending it to our Lamp and Lighting specialists located in the 29 districts we have throughout the country." *W. R. Powell, Mgr., Marketing — Lamps, General Electric Supply Co., Bridgeport, Conn.*

■ In January, 1958 we published "Industrial Lighting" by Ed Arsnow, of the plant engineering department of Western Electric's North Andover, Massachusetts plant. It deals, in part, with the specific aspects of lighting mentioned by Mr. Powell.—*Editors.*

Disaster Planning

PLANT ENGINEERING:

"The articles 'Pre-Planning for Industrial Emergencies and Disasters' which you carried in the May, June and July, 1960 issues have gone into our files as useful reference material.

"If it is not too late, the undersigned would greatly appreciate a set of tear sheets of these articles for use as supplementary material in a course on safety engineering which he is giving at Miami University." *James P. Barnes, Maurice H. Connell & Associates, Miami, Fla.*

Test Cell Maintenance

PLANT ENGINEERING:

"I am extremely interested in reviewing whatever applicable material you have published concerning preventive maintenance.

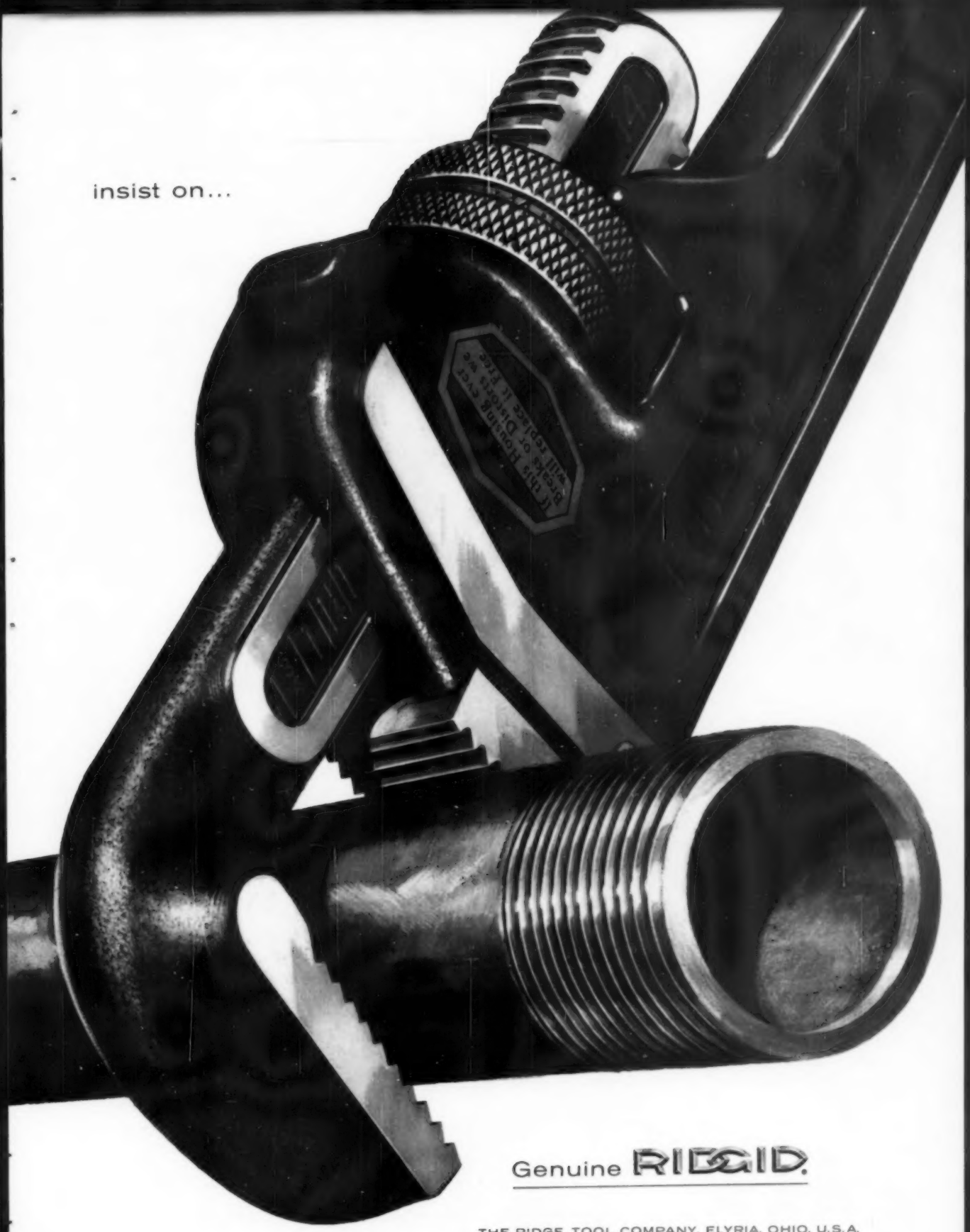
"My chief interests are in the line of servicing jet engine test cell apparatus within this plant. Specifically, I am looking for information on preventive maintenance for liquid/gas handling equipment, electrical/electronic apparatus, and such safety devices as electrical signals, automatic closures and air evacuation systems.

"Since time is of great essence, please furnish a listing of applicable literature at your earliest opportunity. I will review this listing for pertinent articles immediately. Please indicate the cost of each article. Thank you for your assistance." *Charles L. Aydlett, Preventive Maintenance, Jet Engine Department, General Electric Co., Cincinnati, Ohio.*

■ We have sent Mr. Aydlett tear sheets of articles which we hope will help him with those myriad maintenance problems.— *Editors.*

For more facts circle 525 on Reply Card →

insist on...



Genuine RIDGID.

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.

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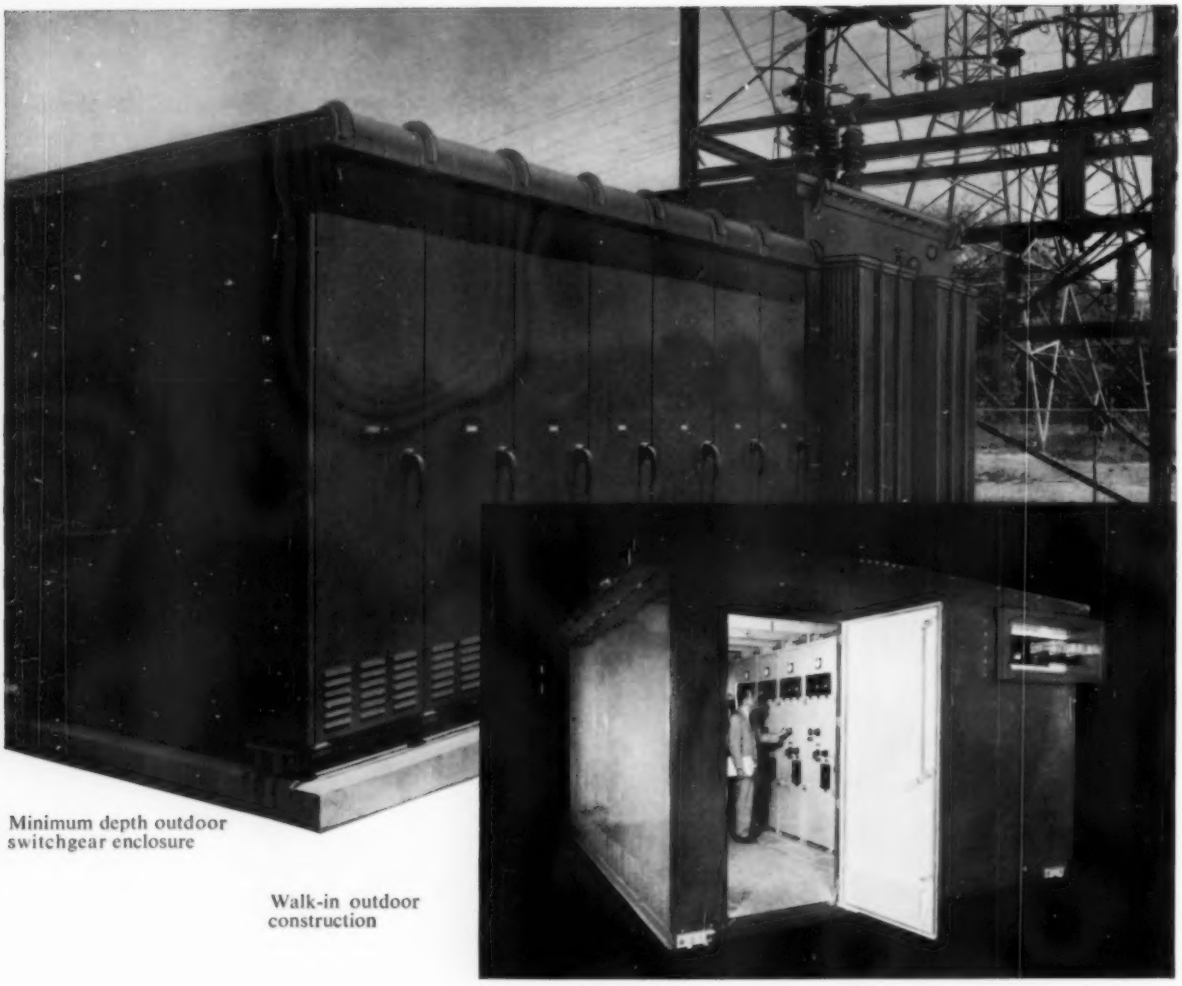

Minimum depth outdoor switchgear enclosure

Walk-in outdoor construction

All-new switchgear makes I-T-E primary unit substation better buy than ever

I-T-E custom designs your primary substation just for you—to meet your exact power, space and future expansion requirements—yet charges you nothing extra. This is just one of the ways that I-T-E gives you a better buy.

And now! I-T-E primary unit substations come with completely new HK switchgear as standard equipment. You get all the advantages of today's most advanced switchgear in outdoor equipment: new compactness, stored energy closing, new ease of access, and new safety for personnel. It's available in minimum depth outdoor enclosures for areas where space is limited, or outdoor walk-in construction for easy maintenance in bad weather. All doors and joints are completely gasketed. All parts are treated for rust resistance and painted prior to assembly.

I-T-E primary unit substations are available in all standard kva ratings and secondary voltages to 13.8 kv. Write for complete information. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

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FLUOR COOLING TOWERS

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You'll get more cooling at lower cost, and longer tower life under all operating conditions with Fluor Cooling Towers. From heavy industrial installations to light central station air conditioning and refrigeration units, there's a Fluor Cooling Tower to meet your specific needs.

higher performance

lower maintenance cost

built-in permanence*

Fluor PRODUCTS COMPANY COOLING TOWERS

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A division of The FLUOR CORPORATION, Ltd.

GENERAL OFFICES: P. O. Box 1267, SANTA ROSA, CALIFORNIA

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December, 1960

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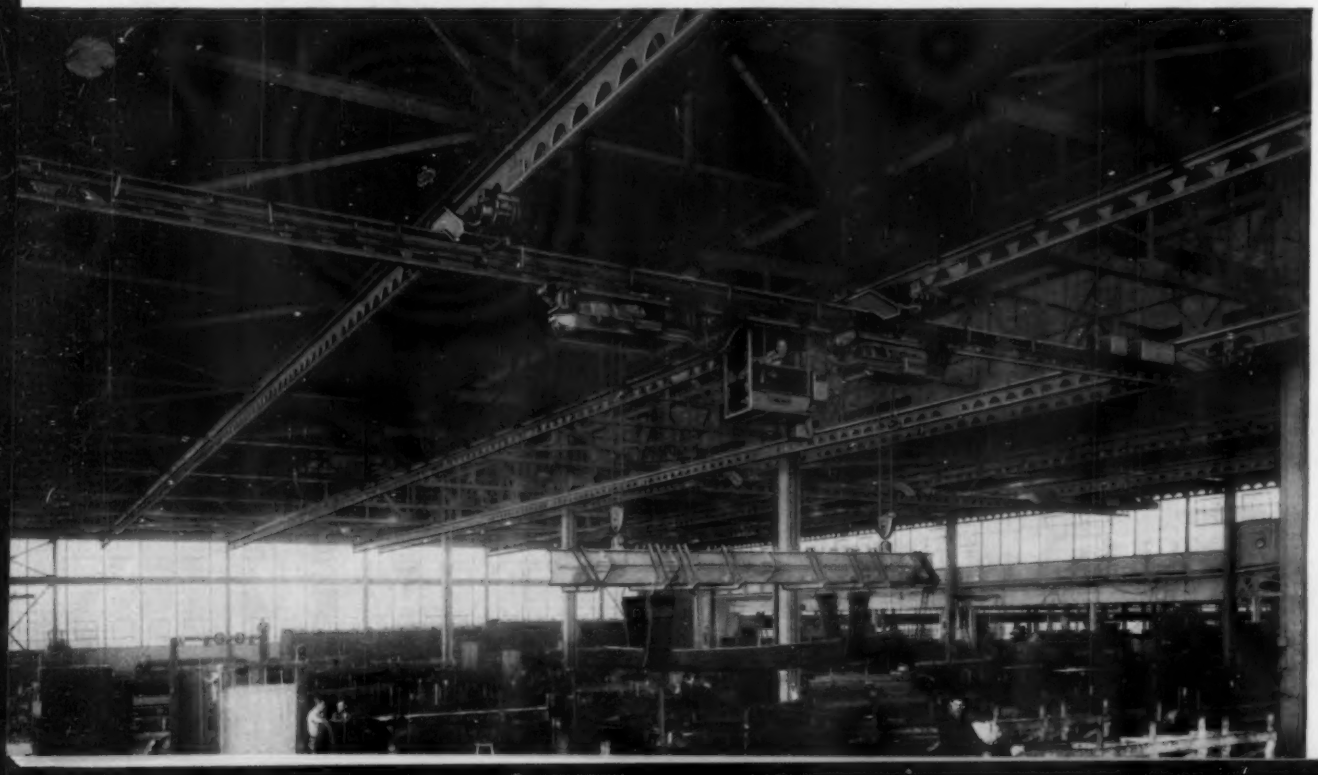
20 TON CRANES FLY AIRCRAFT SECTIONS IN CEILING

Lowering the tail boom of a large airplane into place. These huge units must be handled with extreme care and inched gently into exact position for matching of holes. The Cleveland Tramrail cranes used here are of the transfer type and carry loads to 20 tons.

40-FOOT TUBES HANDLED FAST IN CEILING

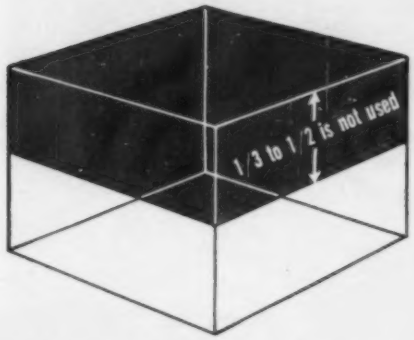
5 ton Tramrail cab-operated transfer cranes move tubes at 300 f.p.m. to all points in this 58,000 sq. ft. room. To convey the tubes from bay to bay with floor trucks would be awkward, slow and require considerable valuable floor space. The two hoist hooks are 16 feet apart and have a lift of 30'-0".



LOOK TO YOUR CEILING

For Big Savings

1/3 to 1/2 the cubic space in the average plant is NOT USED



MANY plants are pinched for floor space, yet are not using a large part of their cubic footage. Much of their large ceiling space is wasted.

By moving all equipment and activities possible from floor to ceiling, many square feet of floor are freed for the addition of production machinery without plant expansion for needed storage areas and other requirements.

Aisleways can be reduced in size or completely eliminated. Machines can be moved closer together. Floor areas used for local stocking can often be done away with.

Materials handling is an operation that can be carried on efficiently overhead. Cleveland Tramrail equipment is handling vast tonnages of materials in the ceilings of thousands of factories and warehouses. Not only do Tramrail cranes and track systems save tremendous areas of floor space, but they speed handling, lower production costs, often by fantastic amounts, and greatly aid safety.

We welcome an opportunity for a Cleveland Tramrail materials-handling engineer to give you the details.

Write for free Engineering and Application Booklet No. 2008. Packed with valuable information.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
7532 E. 290 ST. • WICKLIFFE, OHIO

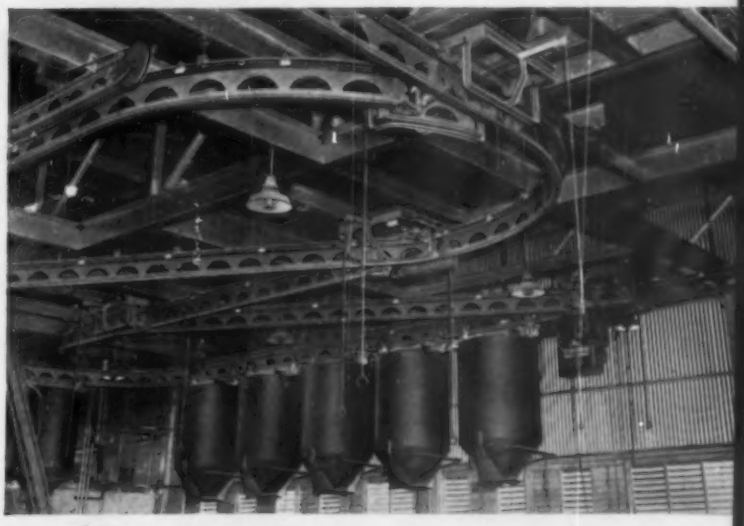
TRAMRAIL CRANES PERMIT LOWER HEIGHT OF CEILING

Both ordinary top-running and Tramrail under-running cranes were considered when this Diesel Repair Shop was planned. Two 5 ton, 63'-0" Cleveland Tramrail cranes were installed. Among other advantages, they enabled a lower building height. This shop is thought to be the finest and most modern of its kind.

TRACTOR PLANT PROFITS BY USING CEILING

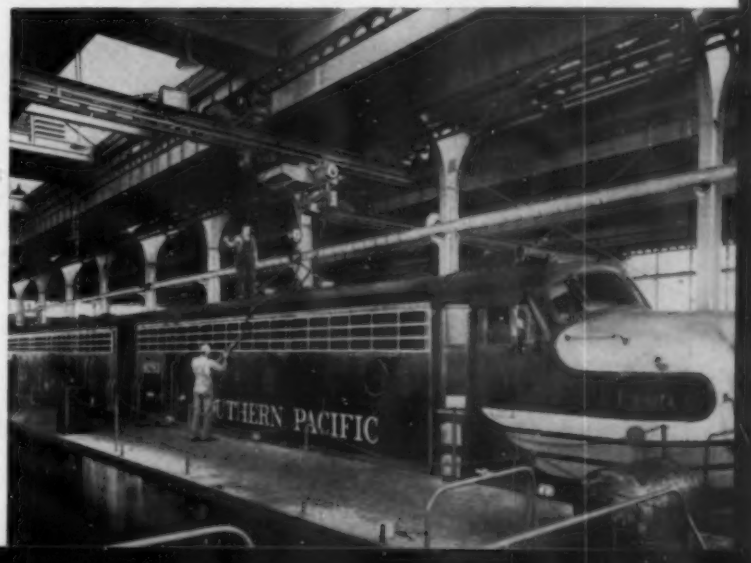
Heavy materials can be moved quickly, easily by one man in every square foot of a plant covered by Cleveland Tramrail cranes.

Some 250 cranes, like these illustrated, eliminate waste time waiting for a lift in this efficient plant.



TRAINS OF BUCKETS CONVEYED IN CEILING

Buckets of materials can be conveyed on Tramrail track and switch system in ceiling by powerful tractor. Control can be automatic if desired. Each bucket in train illustrated has 45 cu. ft. volume and 4000 lb. capacity.



PLANT ENGINEERS' DIGEST®—so those who rush may read and know what's new

Edited by Marjorie E. Weissman

Site Compaction With Sand Proves to Be a More Economical Method Than Excavation

AN UNUSUAL METHOD of site preparation was recently employed by our engineers for the paint products warehouse of the Glidden Paint Co. Through preliminary soil tests, the chosen site was found to have a six- to seven-foot builder's fill which would undergo considerable settlement under the expected live load of 600 lb per sq ft.

Rather than excavate the fill, it was considered more economical to try to compress it with an imposed load prior to the construction of the warehouse. A test area of approximately 1000 sq ft on which eight feet of sand were stored, was used to determine the results obtained by preloading. Accurate readings were taken of the settlement of virgin soil beneath and in the builder's fill. After the loading was removed the rebound was checked. Results from these measurements proved the effectiveness and economic advantages of the loading method.

Following the test procedure, eight feet of sand were dumped onto the site, giving a load of approximately 900 lb per sq ft. The area encompassed by the building, 280 ft by 120 ft, was divided into four segments, each 70 ft by 120 ft.

Engineer measures compaction of warehouse site loaded with 8 ft of sand.

A segment was loaded and compressed to 90 per cent of the compaction that would ultimately occur in three years. This forced compaction took about 10 days for each segment.

In order to ensure a stable foundation for the dead load of the building, the builder's fill was excavated for the perimeter footings and replaced with sand. *From Fore-Cite, published by Fruin Colnon Contracting Co., St. Louis, Mo.*

Bulk Handling Cuts Sugar Delivery Costs

DELIVERING SUGAR in bags to candy makers, bakeries and food processors can be wasteful. The bags have to be loaded from the trailers to fork trucks, then on to skids to go into the plant. Bags sometimes split, spilling sugar. By replacing this type of delivery with bulk delivery, National Sugar Refining Company found that it could cut handling costs and eliminate waste. The means chosen was a transport trailer which pneumatically discharges its 15-ton payload in less than an hour.

Pneumatic handling of sugar cut cost of delivery and maintenance, eliminated need for dust collector in plant.

National Sugar's bulk transport is a 42-ft over-all tractor-semi-trailer unit containing three sugar compartments of 10,000-lb capacity each. The engine, blowers, pneumatic hose connections, and controls are housed in a compartment at the rear of the trailer. In operation, the sugar is funnelled from each compartment into a common, underslung transport line that is connected to a plant pipeline. The trailer can be loaded two ways: by gravity from overhead bins, or by air from the bulk sugar railroad cars.

Since no rotary feeders are used, crystal degradation and inherent maintenance problems are alleviated. Also, the dust-laden air from the user's storage bin is recirculated and then cleaned by a filter installed on the trailer, eliminating the purchase and installation of a dust collector in the plant. The use of this recirculation of the air assures freedom from accumulation of atmospheric moisture. The savings in price are nearly 25 cents per 100 lb over bagged deliveries. *From a release of Fuller Company, Catasauqua, Pa.*

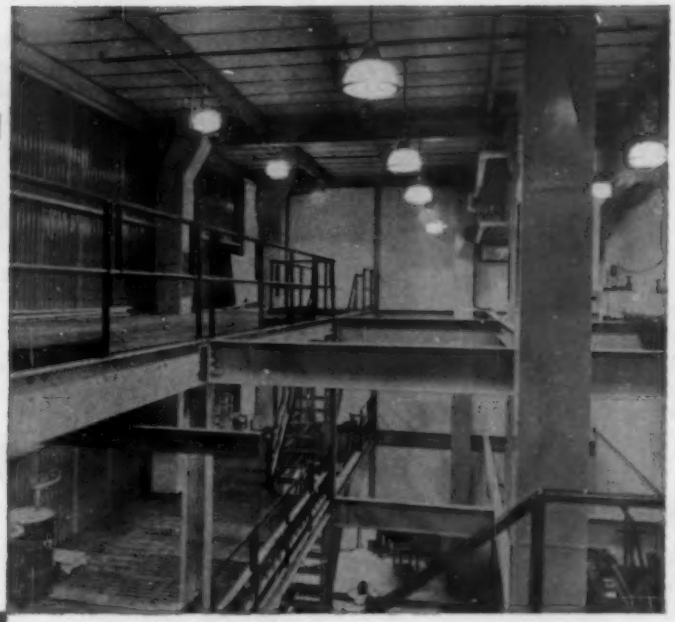
Clearing Air of Frit

ONE OF the major operating problems encountered by the appliance industry is removal from the plant atmosphere of minute particles of frit, the glass-like constituent of por-

(Continued on page 44)

LIGHT

exactly where you need it...



Crouse-Hinds Explosion-Proof Lighting Fixtures in Class I, Group D location

Crouse-Hinds Vaportight Lighting Fixtures in a corrosive outdoor location

regardless of surrounding atmosphere!

When there's something in the air — explosive gases, ignitible dusts, corrosive fumes — Crouse-Hinds has exactly the light to give you lighting exactly where you need it — with complete safety!

Lighting that's safe to operate in explosive concentrations of acetylene . . . hydrogen . . . gasoline vapors . . . organic, inorganic or metallic dusts. Lighting that stands up under the corrosive attack of acids, salts, alkalis.

What *kind* of lighting do you need: Bench . . . area . . . flood? Incandescent . . . fluorescent . . . mercury vapor? Permanent . . . portable?

You'll find them all in the Crouse-Hinds catalog. It's the *only* place you'll find lighting for every Class and Group under the National Electrical Code.

Ask your Crouse-Hinds Distributor.

Crouse-Hinds Dust-Ignition-Proof Lighting Fixtures in grain elevator — a Class II, Group G location

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For more facts circle 529 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 42)

celain enamel. At General Electric's Appliance Park in Louisville, Ky., wet-inertial dust collectors are getting a complete workout on the job.

The collectors are being used at two re-work stations in the home laundry department. At these stations, washer and dryer parts are resprayed with frit if defects have been found in the porcelain surface. The frit, while low in actual particle count, would, if not collected, be annoying as well as potentially dangerous to the men working in the area.

Two 12,000 cfm units were placed adjacent to the two separate re-work areas. One unit is in the same room as the re-work booth, the other is in another room, separated by a wall from the re-work booth.

Unit one, which measures 18 ft from inlet to discharge fan, is separated from the actual re-work area by the room wall. On the other side of the wall is a pickling machine, with only two and one-half feet between the wall and the side of the machine for service access. The dust collector was put in this area, and the wall opened between the room so that the dust could be drawn into the collector.

Wet-inertial dust collector is installed between wall and pickling machine. Intake area is in foreground.

Unit two, the same size as the other, fits into a small, otherwise unused area immediately behind the other re-work booth. The mouth of this unit opens right into the re-work area with no wall separating the two. An arrangement of louvers is on both units to help control the air flow. Noise level of the two units is minimal.

At G.E. the slurry is washed away through two discharge pipes to a large pit where all enamel waste is collected.

Over-all dust removal efficiency in the two units being used is estimated to be more than 95 per cent, with dust loads averaging about 0.07 grains per cubic foot. *From a release of Joy Mfg. Co., Pittsburgh, Pa.*

Reduce Belting Costs

GRINDING ROCK into powder for insulation created extremely difficult atmospheric conditions at the Plymouth Meeting, Pa. plant of Philip Carey Co. One of the biggest problems created by this situation was the short life of the V belts on their compressors, which have a V-to-flat drive.

Big factor in replacing the belts

(Continued on page 46)

New Idea in Audio Visual Aid Instructs Assemblers, Reduces Production Errors

A TAPE RECORDER and slide projector have been teamed up to test an unusual new method for instructing electronic assemblers both experienced and new at our Hawthorne plant.

The audio visual unit works like this: The assembler wears an ear piece and listens to taped instructions as she works. After each instruction is given, the recorder stops and the assembler performs the operation. When she is ready to continue, she starts the tape again with a foot pedal. Thus the assembler and not the tape unit sets the pace of production.

Audio visual unit gives instructions to assembler. Projected slide is in color.

The tape recorder, in turn, automatically triggers the slide viewer so that as the assembly progresses, slides of the prototype assembly are shown in the same state of completion. The assembler can compare her assembly with the one on the screen and can see the wires, resistors, etc., that are referred to in the taped instructions.

Five experimental audio visual units have been in use since April and on the basis of data gathered so far, production time can be significantly reduced by using these units. The number of errors made in assembly has been sharply reduced by this method, mainly because of the complete instruction provided. *From a magazine published by Nortronics, Division of Northrop Corp., Anaheim, Calif.*

THIS FREE BOOK COULD HELP PREVENT AN ACCIDENT WHERE YOU WORK

You owe it to yourself, and the men you supervise, to learn all about the safety, comfort, and economy of USS Multigrip Floor Plate. This free booklet illustrates the many applications for Multigrip—from plant floors to derrick platforms to ship ladders. What you see in these pages may prevent an accident in *your* future.

Ask for the USS Multigrip booklet at your nearest Steel Service Center or U. S. Steel district sales office. Or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS is a registered trademark

United States Steel Corporation—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
Columbia-Geneva Steel—San Francisco
United States Steel Export Company
United States Steel

This mark tells you a product is made of modern, dependable Steel.

For more facts circle 530 on Reply Card

"Call FOSTER for Rail"...Get Relayers PLUS

Installing or expanding in-plant trackage? Foster will deliver Quality Relaying Rail at lower cost . . . "plus" all necessary new track accessories, switch material—even the track tools to do the job. To help select the materials best suited to your job, call the Foster Track Specialist.

You will save on freight from Foster's nationwide warehouses, all of which stock all sections of relaying rail "plus" new rail for crane runways and specialized applications.

Another "plus": Foster's Track Inspection Kit, which illustrates all the elements needed for an efficient industrial siding. It's a real help for proper track maintenance.

Write **L. B. FOSTER CO.** for free Track Kit PE-12 Pittsburgh 30, New York 7, Chicago 4, Houston 2, Los Angeles 5, Atlanta 8, Cleveland 35.

Faster From Foster

Pipe • Rental Steel-Sheet Piling • Pipe Pile • Rail

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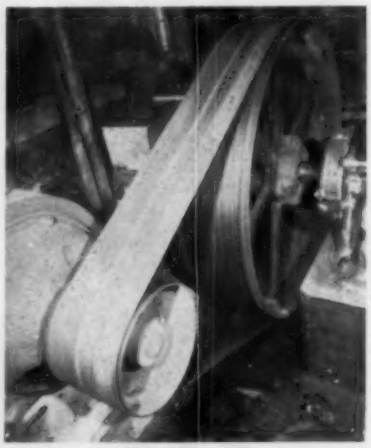
PLANT ENGINEERS' DIGEST

(Digest begins on page 42)



Elastic belting on compressor operating under severe conditions shows no wear after six-months-long test.

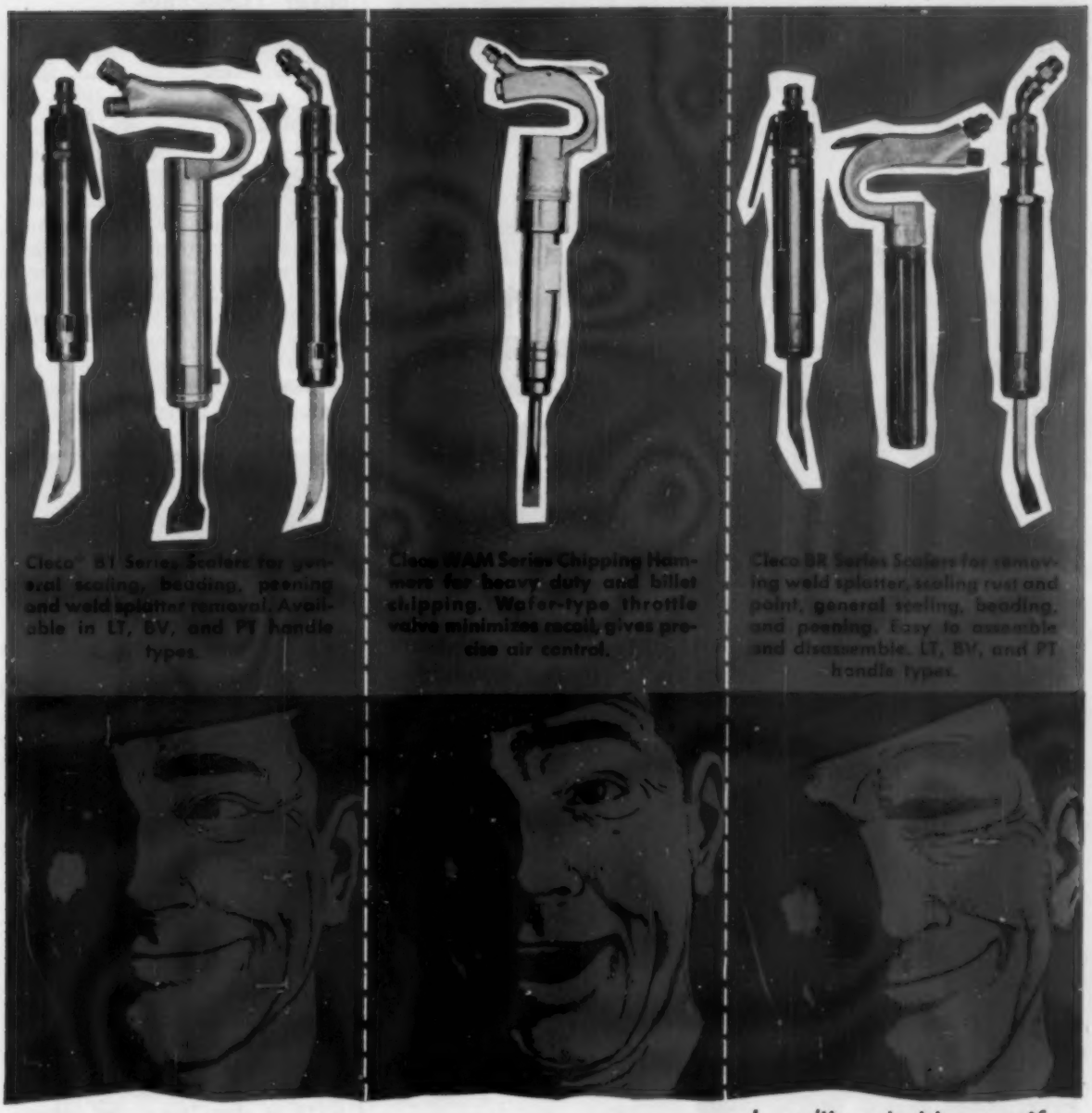
was not the initial cost of the belts, but the time required for the job. Installing new belts meant that the compressors were out of operation for three to four days because it was necessary to disassemble the main shaft to get the belts over the pulleys.

Carey Plant Engineer Harry Pfau switched from V belt to flat belt drive using a 12-in. Texalon belt, to solve the problem. During a six-month test period, performance of the belting was checked closely. After six months, there were no signs of wear and the belt has shown no slippage. While the belting is almost completely elastic, it is free of stretch. It will lengthen under load, but when the load is removed, belt returns to its initial tension. *From a release of J. E. Rhoads & Sons, Wilmington, Del.*

TV Eliminates Blind Spot

WHILE DOUGLAS Aircraft facilities engineers in the jetliner assembly plant were working on plans for an automatic riveter installation, it became apparent that television must become an integral part of the machine operation.

The specially designed riveter is programmed by tape prepared by means of a digital to analog converter. Fuselage panels, 31 ft long, held in a 40-ft tooling frame, travel longitudinally on a 90-ft floor-mounted tack, while being automatically riveted. Tack rivets every five feet



Cleco* BT Series Scalers for general scaling, beading, peening and weld splatter removal. Available in LT, BV, and PT handle types.

Cleco WAM Series Chipping Hammers for heavy duty and billet chipping. Wafer-type throttle valve minimizes recoil, gives precise air control.

Cleco BR Series Scalers for removing weld splatter, scaling rust and paint, general scaling, beading, and peening. Easy to assemble and disassemble. LT, BV, and PT handle types.

Look them over, try them out, and you'll probably specify Cleco chippers and scalers

There's just no way to go wrong when you specify Cleco chippers or scalers. These rugged tools are industry renowned for their job efficiency; for their outstanding utility, interchangeability, and dependability features. Before buying your next chipper or scaler—try Cleco. The Cleco line includes a model to fit your particular job requirements.

For a free demonstration-tryout, call your local Cleco representative. For descriptive literature write:

CLECO
AIR TOOLS

A DIVISION OF REED ROLLER BIT COMPANY
P. O. Box 2119 • Houston 1, Texas
IN CANADA: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Leaside (Toronto), Ontario

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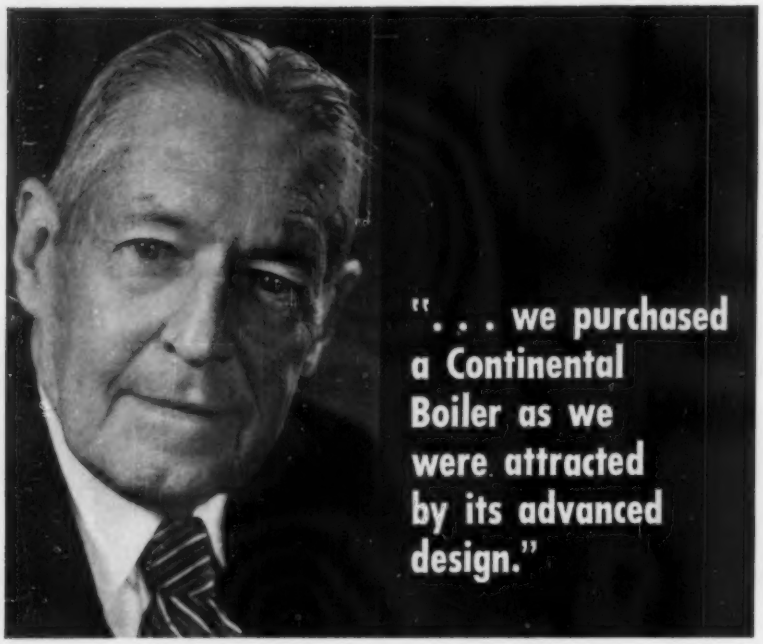


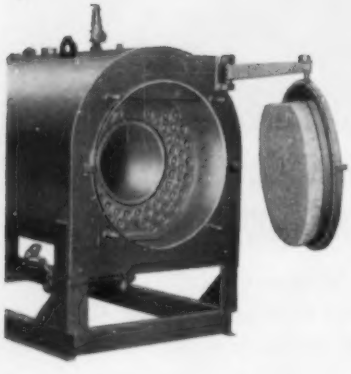
Continental

2-PASS

AUTOMATIC BOILERS

THE CONTINENTAL 2-PASS DESIGN is the most practical approach to pressure vessel design. Over the years, this simplified construction has proved conclusively that the Continental is the one boiler that consistently delivers highest efficiency with outstanding operating and maintenance advantages.

In service on hot water systems, Continental 2-Pass Boilers have had 100% success . . . and no Continental Boiler—steam or hot water—has ever suffered from "thermal shock."



SIMPLICITY *of Continental 2-Pass construction eliminates need for costly, troublesome, complex refractory at back of boiler—as can be seen in view of open rear cover at left.*

Send for details of new boiler Leasing Plan and Bulletin BE-400.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

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PLANT ENGINEERS' DIGEST

(Digest begins on page 42)

are used as synchronization points to check precision of the programming.

One man operation, however, presented a problem because the position of the machine operating controls placed the operator in a blind position to the rivet ram. This necessitated either another man or some type of monitor to alert the operator as to panel position and synchronization of panel and tape, but there was no safe place to locate the second man. A special system employing two

Position of riveter is checked by means of reticle circle projected on aircraft assembly line TV monitor.

TV cameras and two 17-in. monitors was devised to solve the problem. Each camera projects a special crosshair reticle on its monitor screen. In the center of the reticle is a circle, 0.156 in. diam, which the operator uses in bore sighting tack rivets used as tape-to-panel synchronizing points when operating under automatic tape control. The reticle circle is the diameter of the smallest hole drilled (0.156 in.). Thus if the operator places a pilot hole anywhere within this circle, it can be drilled with precision. The TV monitor magnifies the holes 2.7 times. *From a release of Telautovision Division of TELautograph Corp., Los Angeles, Calif.*

Valve Gasket Prevents Blowout

WHEN A VALVE was misapplied on the pipeline of Mid-America Pipe Line Co., the special flange seal, con-

LOOKING FOR A LOW-COST APPROACH TO MAINTENANCE PAINTING?

Lou Oyster's an old-timer in the field of maintenance painting. A member of Du Pont's special Technical Service Group, Lou's an expert whose aim it is to help you solve maintenance painting problems of every type and size. As he sees it:

"To make sure you realize maximum returns on every maintenance dollar spent for paints and painting, think in terms of *CPSFPY*—cost per square foot per year—rather than cost per gallon. *CPSFPY*—Du Pont's approach to paint maintenance—brings in two additional factors of equal importance: *service* and *job satisfaction*.

"You see, when you specify Du Pont, you're getting a complete paint *system*, specifically geared to your needs. Naturally, we start with the finest finishes available—like our Mildew-Resistant Enamel, for instance. This tough, durable finish effectively resists mildew formation and stays bright for years. Like all Du Pont Maintenance Paints, it's pre-tested to assure dependable performance.

"Teamed with top-quality paints is what we call technical assistance. This means going right into your plant to analyze the problem at firsthand. Once done, we can sit down with your engineers and plant supervisors and draw up a sound, workable program that considers both maintenance and budgetary requirements. Service like this helps you achieve efficient, long-range protection, *at lowest cost per square foot per year.*"

There are men like Lou Oyster working out of Du Pont district sales offices from coast to coast. Why not let one of them put his training and experience to work for you? Give him a call, or write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. PE-612, Wilmington 98, Delaware.

* * *

Lou Oyster has had more than 30 years' experience with Du Pont's Finishes Division. His diverse background in the field of maintenance painting includes extensive experience in mildew control, sanitation and corrosion problems for the dairy, meat-packing, cereal, chemical, petroleum and paper industries in the South and Midwest.

DU PONT PAINTS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

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NEW DRAW-OUT DESIGN

Speed maintenance via air... Gardner-Denver air and tools

Waste no time. Put Gardner-Denver air power and tools on your maintenance team. Fast-acting Gardner-Denver air tools help your crew make the most of maintenance hours. Impact wrenches • air hoists • paving breakers • trench diggers • sheeting drivers • backfill tampers • utility drills • grinders • ratchet wrenches • concrete vibrators • nut setters.

Compact Gardner-Denver rotary portable compressors provide a steady, dependable supply of low-cost air. Rugged drawbar makes Gardner-Denver rotaries easy to move. Jackleg provided for quick setting-up. Big toolbox for air hose and tool storage. Write for information.

Gardner-Denver RP85-G (85 cfm) rotary portable air compressor

Gardner-Denver RP125 (125 cfm) rotary portable air compressor

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

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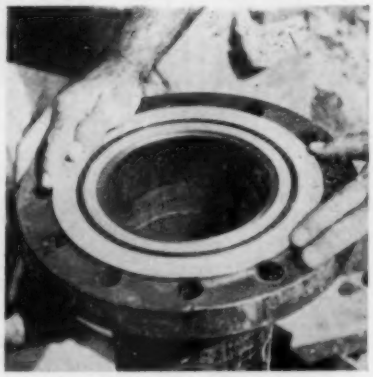
PLANT ENGINEERS' DIGEST

(Digest begins on page 42)



Seal requires only a spanner wrench to install it. Seal is blowout-proof.

sisting of a "rubber" ring completely confined in a metal retainer, did not blow out, but only weeped. Pressure did not drop appreciably and it was possible to seal off the area with a "plug seal" joint, remove the valve and replace it with a new one. The job took several hours.

The metal and rubber seal is reusable and is installed with ordinary 18-in. spanner wrenches. It can be removed by parting the flanges enough for it to drop out or be pushed out with a wood ruler or similar tool. *From a release of Parker Seal Company, Div. of Parker Hannifin Corp., Culver City, Calif.*

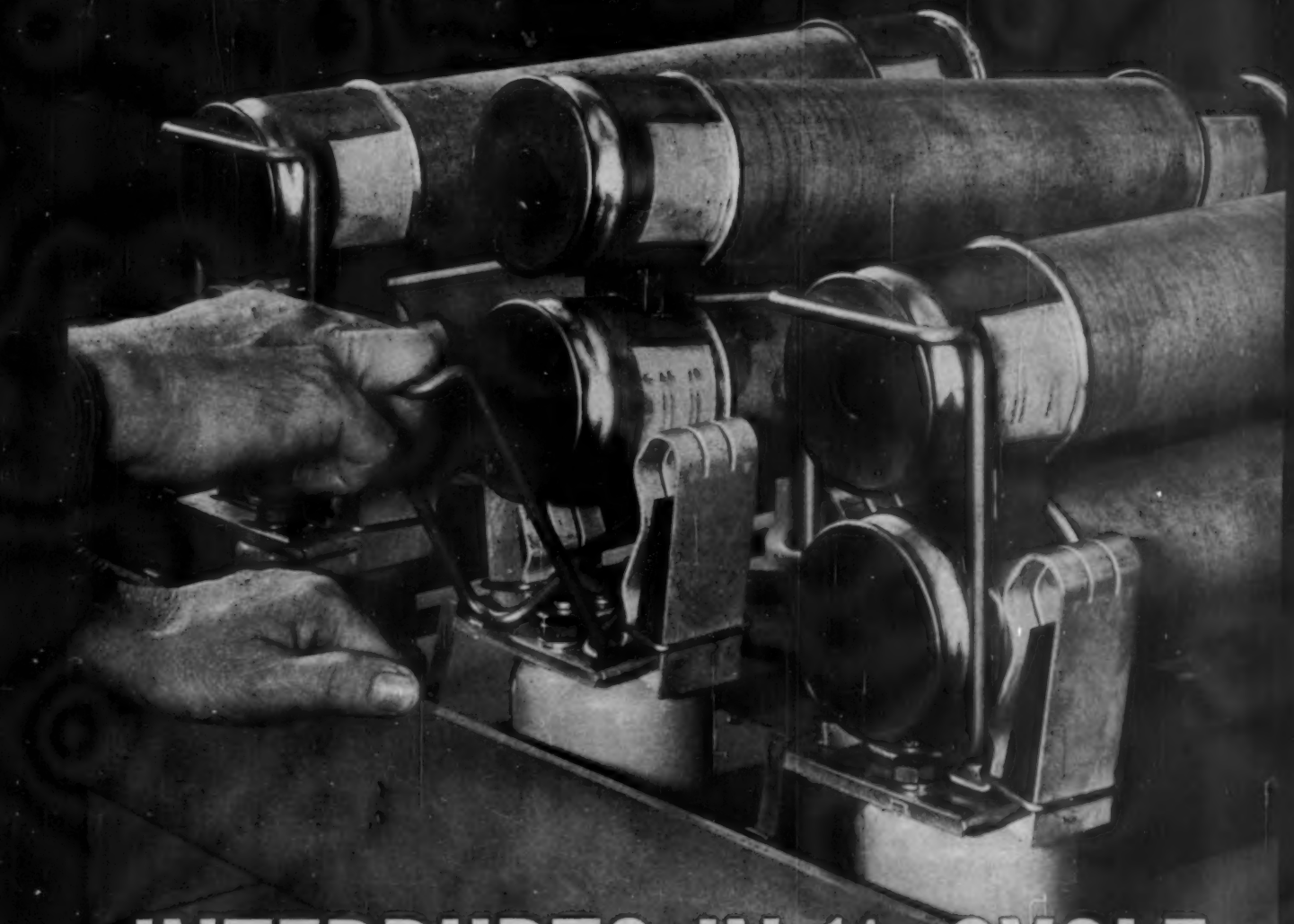
Alignment of Conveyor Belts

PROPER ALIGNMENT from head shaft to tail pulley is the starting point for maintenance of belt conveyors. Both carrying idlers and return idlers should be level and installed so that the long axis of the flat roll is perpendicular to the center line of the belt.

Training idlers rather than rigid side guide idlers should be used for training a belt. The belt edges which bear against these guide idlers frequently are loosened and can be worn through and permit the entrance of moisture and dirt between the plies of the belt. This, along wth excessive wear of the belt edges, accelerates belt failure.

It is a mistake to try to train a belt by increasing the tension. This not only strains the driving mechanism, but it places an unnecessary stress in the belt, weakens the splices, reduces

NEW DRAW-OUT DESIGN
LIMITAMP* MOTOR CONTROL



INTERRUPTS IN ½ CYCLE

. . . protection when you need it—with Limitamp control

Rated 2300- to 4600-volts for a-c motors up to 3000 hp.

Here is performance you can count on . . . to start, stop and protect your motor under *your* environmental conditions!

General Electric's new draw-out Limitamp control is designed to interrupt in the first ½ cycle. Current is limited in the first ¼ cycle. EJ-2 fuses—the standard of excellence—give you this dependable short-circuit protection.

The new draw-out contactor is designed to give outstanding performance under all conditions of load—from small motors running light to large motors at "locked rotor." This improved performance comes from a new blow-out structure and an improved arc chute with superior extinguishing action.

The new contactor also meets a 60-kv base impulse level. Performance of the entire design has been exhaustively tested in General Electric's high-voltage laboratories . . . and, complete design coordination of bus, cable, current transformers, contactors, fuses, insulators and overload relays means top protection for men and equipment!

Ask your G-E Apparatus Sales Engineer or Agent about other advanced-design performance, maintenance, installation and operation features of new Limitamp control. Or, write Sect. 783-12, General Electric Co., Schenectady, N. Y. for Bulletin GEA-6893. Industry Control Dept., Salem, Va.

Progress Is Our Most Important Product

GENERAL ELECTRIC

* Reg. Trade-mark of General Electric Company

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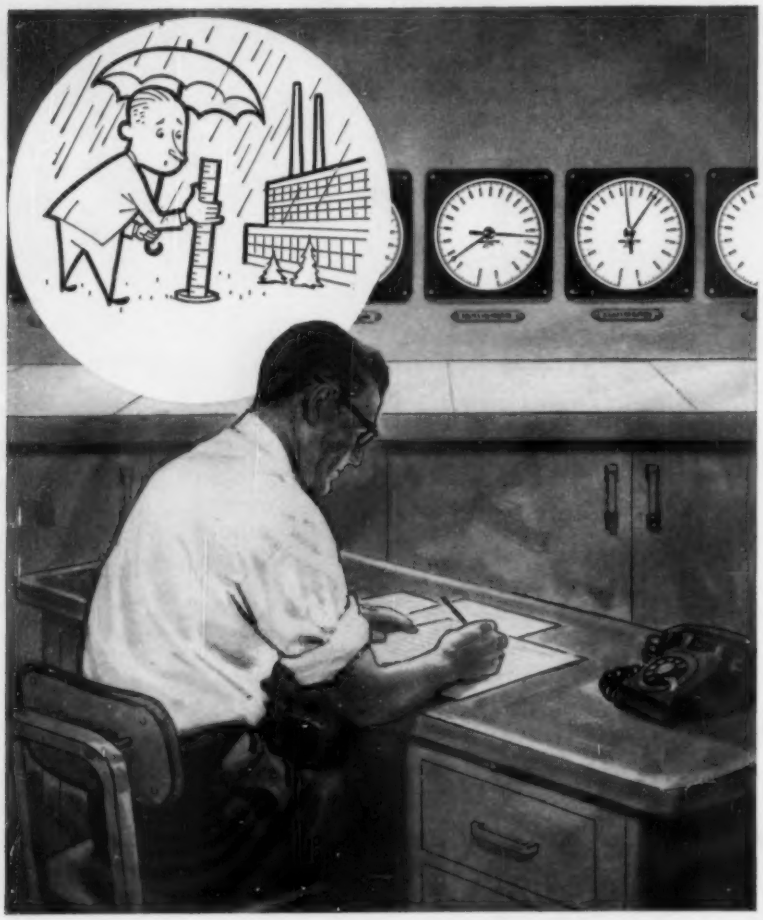

Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way... without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. B, LONG ISLAND CITY 1, NEW YORK

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PLANT ENGINEERS' DIGEST

(Digest begins on page 42)

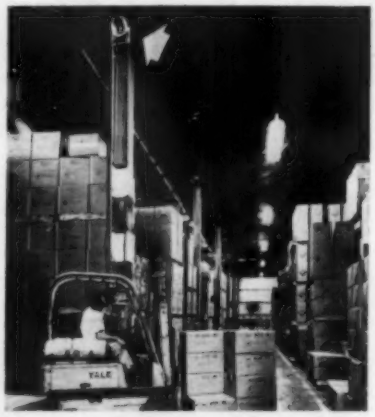
the troughing of the belt (and its carrying capacity) and prevents effective training of the center idler roll.

When one section of a belt runs true and central on the idlers and another section runs out of line along all parts of its travel, it is either crooked, or not centrally loaded. If the part that runs out is at the splice, it is probable that the splices or joint are not square.

If a belt keeps running out on the same idlers, the idlers are out of line. Usually the idler or idlers causing the trouble may be found just behind the point where the belt starts out of line. To correct this condition, cant several preceding idlers slightly.

Alignment is critical with reversible belts. Where a movable belt unloading device, such as tripper is used, the centering and holding of the tripper in alignment is also important. The troughing or flat idlers that support the belt should be kept free and turning at all times. Material should not be permitted to build up around the idlers and keep them from turning. This is hard on the rubber belt cover and can cause the belt to run off the idlers. *From a talk by C. W. Cassells and E. J. Kamp, Engineering Field Service Div., Link-Belt Co., before A.S.M.E. Maintenance and Plant Engineers Div. Conference, 1960.*

Talk, Don't Walk



Communications in 42,000 sq ft warehouse of Ekco-Alcoa Container Corp., Wheeling, Ill., are now simplified with Ring-Master two-way system combining features of intercom and telephone. (From a release of Scan-Am Company, McHenry, Ill.)

Now . . . pull the fan wheel or motor while DeBothezat® Bifurcator® Fan remains in duct.

Not just an access door. Half the entire cone comes off.

Speed up inspection . . . slash maintenance and downtime costs.

This removable cone design is an exclusive feature found only on DeBothezat Bifurcator Fans.

Published ratings on DeBothezat Fans tell you exactly what the complete fan unit puts out. No guess work — no allowance to be on safe side!

New design duct fan

De Bothezat® FANS

DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

THIS COUPON ANSWERED WITHIN 24 HOURS

DeBOTHEZAT FANS DIVISION, Dept. PE-1260
American Machine and Metals, Inc.
East Moline, Illinois

Gentlemen: Your new Removable Cone feature for DeBothezat Bifurcator Fans looks good to me. Please rush descriptive literature at once.

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NIAGARA FILTERS • UNITED STATES GAUGE • RAHM INSTRUMENTS • LAMB ELECTRIC COMPANY • HUNTER SPRING COMPANY • GLASER STEERS CORPORATION

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Hall Industrial Water Report

VOLUME 8 DECEMBER 1960 NUMBER 6

Pouring Oil on Water

Oil will quiet angry waters. But when oil is inadvertently introduced to boiler feedwater it can cause plenty of trouble with blistered tubes and carryover. Other contaminants in makeup water or condensate can be equally or even more dangerous. Thus, for good boiler operation it is essential to keep boiler feedwater free of significant quantities of contaminating materials.

It is part of the Hall engineer's job to help you locate possible sources of contamination before difficulty occurs. When, in spite of all precautions, something troublesome does get into the boiler feedwater, he is prepared by his training and experience to help you to locate the source quickly. He is also prepared to be of service on all your water problems whether they be in the boiler house, in process, in cooling systems or in waste disposal.

Silica Trouble

An unusual condition caused production losses in an Eastern paper mill. Makeup water for the high-pressure boiler was clarified with aluminum sulfate and activated silica and then deionized. When upsets occurred in the clarifier, colloidal silica passed through the deionizer and into the boiler. This resulted in high boiler water silica concentration, which necessitated boiler operation at lower than normal load. Hence, loss of production.

Hall engineers studied clarifier operation by means of numerous jar tests. These showed that substituting a non-siliceous Hagan coagulant aid for activated silica would produce satisfactorily clear water with complete elimination of silica carryover. A bonus was a more than twenty percent increase in anion exchanger capacity due to the decrease in the silica content of the clarified water.

Tracing Condensate Contamination

Foaming of the boiler water at a midwest manufacturing plant indicated that contamination of feedwater was occurring. A further indication of contamination was difficulty in testing—when an alkaline oxidizing reagent was added to samples for oxidation of organic matter in the phosphate test, the water turned black.

The condition in the phosphate test was checked by Hall field engineer Earl Hoehn. He discovered that he got the same black color when he added the reagent to some condensate samples. He then used this unusual but timely test to trace the contamination to its source. It turned out to be nickel plating and metal cleaning solutions, which were getting into the condensate through small leaks in the steam heating coils in the solution tanks. The reaction between the nickel and the alkaline oxidant was producing black nickelic hydroxide.

Boiler Cleaning Problem

Many of the compressors and pumps in a New York State hospital are driven by reciprocating engines. The oily exhaust steam is used for space heating and heating hot water. The condensate is then returned to the boilers.

Because of the lack of oil removal equipment there is so much oil returned to the boilers at times that some can be seen floating on boiler water samples. Oily sludge accumulates and boiler cleaning is a real problem. A turbine quickly becomes fouled so badly it is valueless. The only effective procedure the operating men discovered was swabbing out the tubes with rags soaked in a solvent.

When Hall field engineer Sam Dilcer learned about the problem he tried boiling out the boilers with a strongly alkaline metaphosphate-metasilicate (Calgonite) solution. This is usually effective but in this case the amount of oil in the sludge deposits was so great the boilers remained dirty. Wire brushing was necessary and the wire brushes became fouled so rapidly they had to be rinsed in a solvent after passing through one tube.

Dilcer then recommended boiling out with Calgonite plus a cleaner of the emulsified hydrocarbon type (Calgon Emulsion Cleaner). This left nothing to be desired. Wire brushes drawn through the tubes remained clean. The plant engineer told Dilcer, "You licked our problem with the boilers so we'll have to find something else to keep you busy."

New Booklet Available

A new 24-page booklet describes the many ways industry can use Hall Laboratories industrial water consulting services.

For your copy, write on your letterhead to:

HALL LABORATORIES
HAGAN CENTER, PITTSBURGH 30, PA.
Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

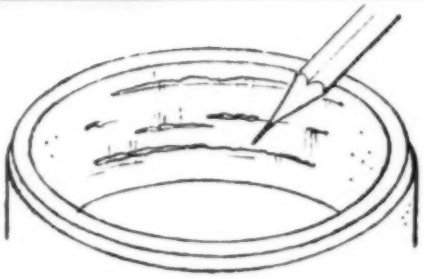
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

For more facts circle 539 on Reply Card

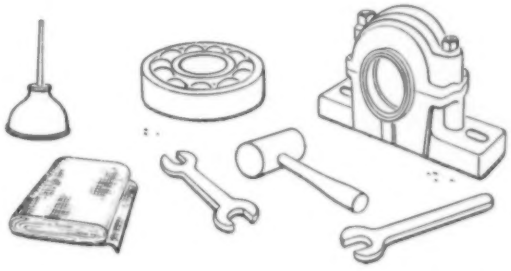
DISTRIBUTOR DAN the SKF bearing man, tells

WHAT DIRT DOES TO BEARINGS

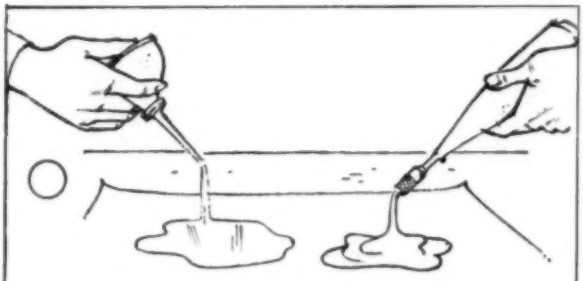
—and how you can help keep it out



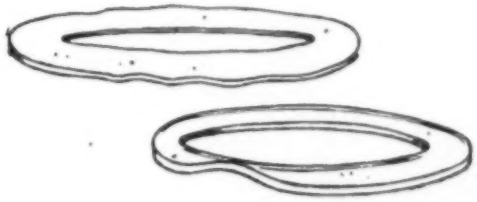
LOOK FOR POLISHED, CLEARLY-MARKED BALL OR ROLLER PATHS. They're sure signs that dirt is getting into your bearings, causing lapping of the parts and ultimate failures. To eliminate this problem, follow the steps shown here.



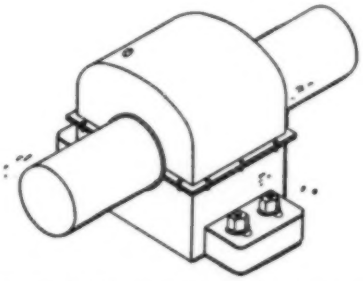
START WITH GOOD "HOUSEKEEPING." Work with clean tools in a clean area. Before you replace a bearing, clean the housing—both inside and out. Always handle a used bearing as carefully as you would handle a new one.



LOOK OVER YOUR LUBRICANTS AND LUBRICATING EQUIPMENT. Dirty oil and grease carry foreign matter with them, right into the bearing. So check them for cleanliness before you use them —and your grease guns and oil cans, too.



IS THE SEAL BENT OR WORN? If it is, dirt and dust and other foreign matter can get into the bearing. If moisture or water is present, you'll need seals made of special moisture-resistant materials.



WHERE DIRT IS A CONTINUAL PROBLEM, try shrouding the bearing housing in a metal box like the one shown here. It's inexpensive, easy to build and helps deflect dust and dirt away from the bearing.

Whenever you're baffled by a bearing problem, consult your Authorized SKF Distributor. His staff of experienced bearing specialists are always ready to serve you—and he stocks all types and sizes of the bearings you need, ready for immediate delivery.

SKF

AUTHORIZED DISTRIBUTOR

6006

Spherical, Cylindrical, Ball, "Tyson" Tapered and REED Miniature Bearings

EVERY TYPE—EVERY USE

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Now! Make any pushbutton station you want with new, completely versatile Cutler-Hammer oiltight pushbuttons

Choose from a complete line of operators, get greater circuit flexibility than with any other make

To meet today's need for a broad range of oiltight pushbuttons, Cutler-Hammer gives you a new versatile line.

You can get these rugged proved pushbuttons in one hole or base mounting, six bright colors. More than thirty different circuit arrangements are available plus hundreds of varieties of stations in standard arrangements of up to 25 elements. And you can get up to 8 circuits on one pushbutton. The flexible oil resistant diaphragm behind the button is designed to stay soft and pliable permanently.

With Cutler-Hammer pushbuttons you can get more control in less space, too, because they use 40% less behind the panel space than the next smallest unit.

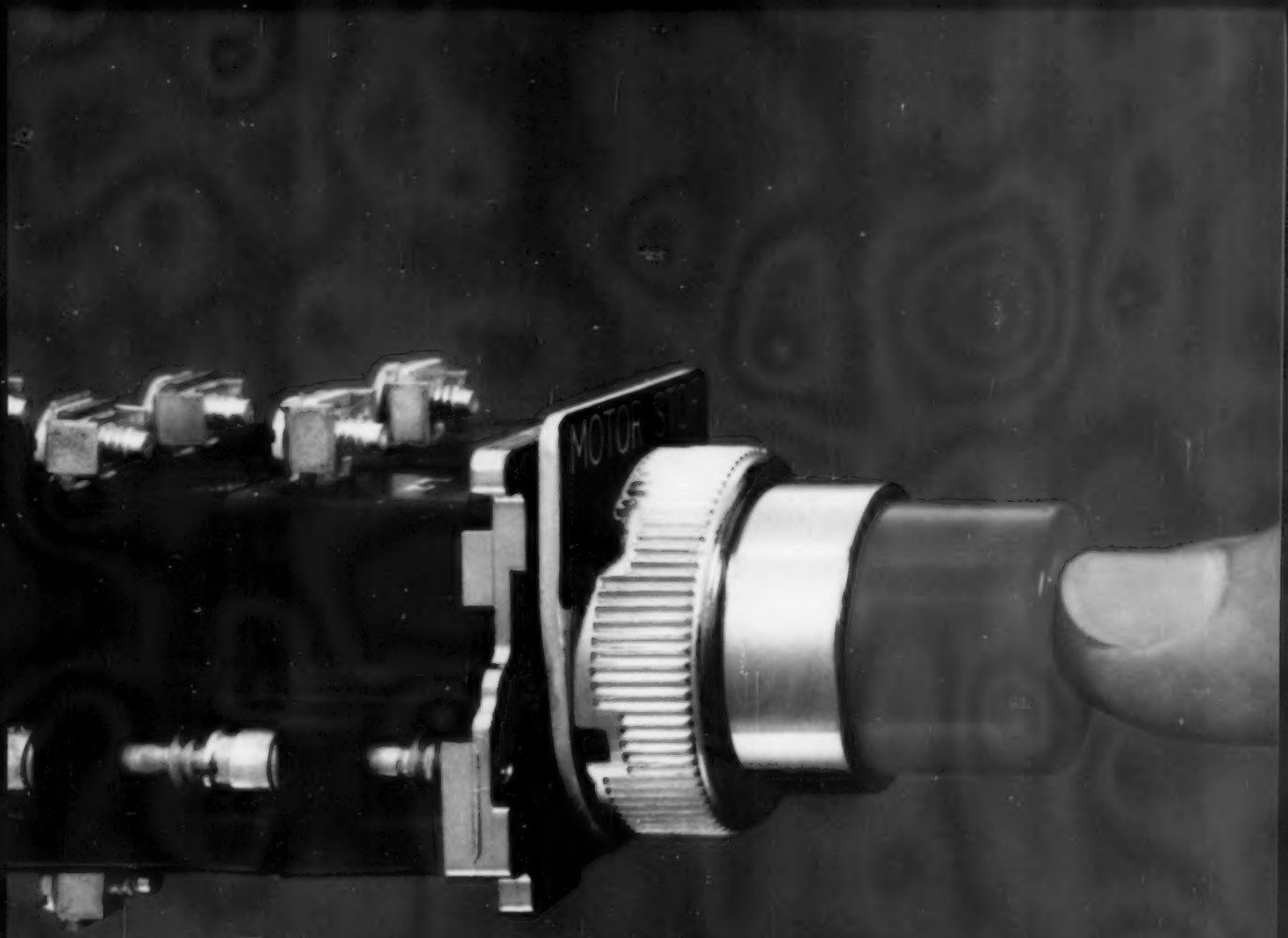
Get all the facts by sending for the colorful brochure, "MASTER DESIGN" which tells you all about the Cutler-Hammer line. Ask for Pub. LO-104.

What's new at Cutler-Hammer? You can see the newness in the products coming from Cutler-Hammer, like the new smaller pushbuttons; in the new manufacturing facilities; in the new engineering ideas. All to give you better service today and in the future. Contact the nearest Cutler-Hammer sales office or your Cutler-Hammer distributor.

WHAT'S NEW? ASK...

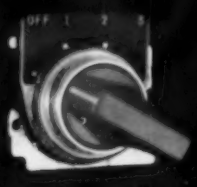
CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.



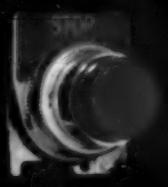
NEW ILLUMINATED PUSHBUTTON. Newest addition to the versatile line.

YOU CAN GET ALL THESE TYPES OF CONTROL UNITS



LEVER

MUSHROOM



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RESISTOR LIGHT

KEY

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GUARDED

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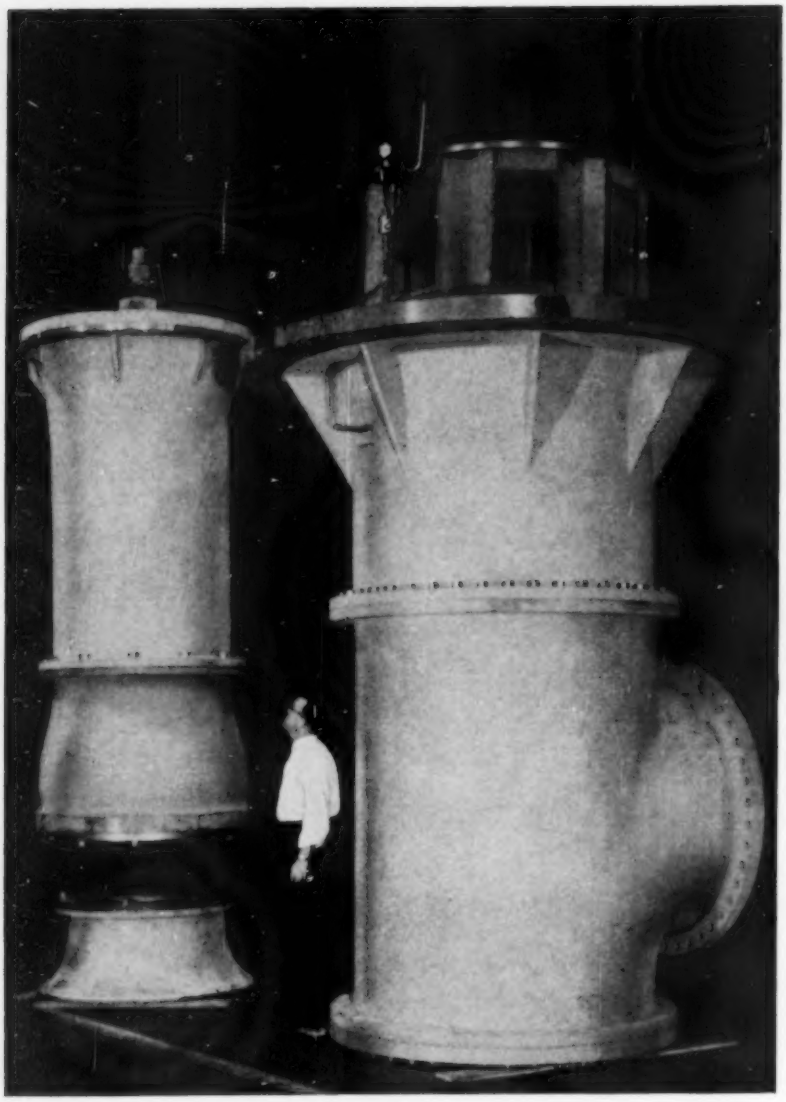

Casing a big job—The heavy casing for these pumps for a Florida power plant is made of 2% nickel cast iron. With its tight, uniformly dense grain structure, nickel cast iron improves pressure tightness and tensile strength. The larger pump can deliver cooling water to a condenser at the rate of 88,000 gpm.

Stepping up fluid handling efficiency

Iron castings meet heavier demands...when alloyed with Nickel

Higher loads...higher pressures... higher temperatures...you can safely have them with nickel cast irons.

Through the use of Nickel—alone or in combination with other alloying agents—the engineering properties of cast iron can be *controlled*. And this control can be precise enough to meet a great variety of service requirements encountered today.

Nickel alloyed gray iron castings are widely used throughout industry. Here are some of the advantages they offer:

- Improved tensile and compressive strengths
- Greater resistance to wear
- Easy castability—uniform density throughout light and heavy sections
- Ready machinability with good physical properties
- Improved rigidity
- Uniform response to heat treatment
- Improved resistance to heat and thermal shock
- Pressure tightness

You'll do well to specify nickel cast irons for original plant construction in fluid handling applications...and for replacement parts in compressors ... pumps ... valves ... cylinders ... liners ...

Six different types of nickel cast irons, corresponding to ASTM specifications, can be adjusted to meet specific service needs.

Full information on all the nickel cast irons can be found in our 28-page illustrated bulletin, "Engineering Properties and Applications of Nickel Cast Irons." A copy belongs in your reference files, and we'll be glad to send one on request. Just ask for "Bulletin A-69."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N.Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

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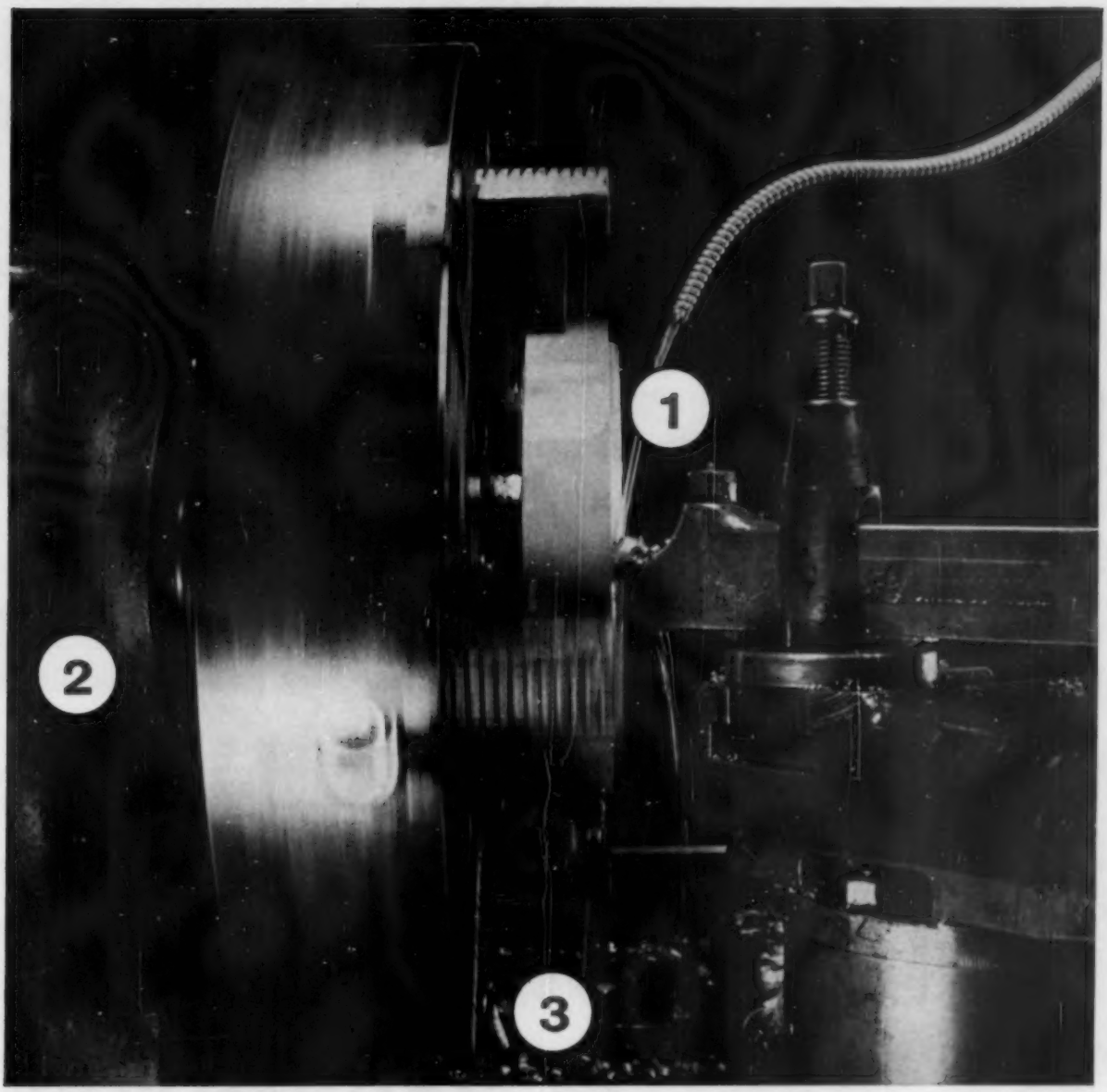

CUT THROUGH PRODUCTION LAGS WITH ESSO LUBES

1. Fanox® high-wetting, non-staining oils for use in cutting non-ferrous metals and for quenching and drawing all metals. The low viscosity of Fanox 32 helps boost the heat dissipation rate to speed the work . . . as in the aluminum machining above.

2. Nuto® oils protect highly finished gear surfaces from excessive wear and rust. Resist foaming to assure ample lubrication. Oxidation inhibited to prevent sludging . . . provides month-after-month service.

3. Febis® K lubricants insure smooth-sliding ways . . . boost precision by eliminating "stick-slip" movement. These lubes actually make static friction less than sliding friction; easily pass the stick-slip test.

There's a complete line of specialized Esso Lubricants to help you cut through production lags. Contact your local Esso office or write: Esso Standard, Division of Humble Oil & Refining Company, 15 West 51st Street, New York 19, N. Y.

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In Industry after Industry... "ESSO RESEARCH works wonders with oil"

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WESTINGHOUSE
40W HIGH EFFICIENCY
PREHEAT-RAPID START
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Westinghouse HIGH the brightest 40-watt lamps you

- 3200 lumens output for 40-watt lamps
- 6400 lumens output for 96" Slimline lamps
- No premium cost
- No extra cost for power
- Just snap into your present fixtures

W !

EFFICIENCY Lamps... and slimline fluorescent can buy

Now you can increase the lighting level in your factory, office, warehouse or store without changing a single fixture, without adding to power costs and without paying a premium price for the lamps.

These new High Efficiency Westinghouse Fluorescent Lamps (40-watt Universal and 96" Slimline types) give 15% more light than the cool white and 36% more light than the daylight lamps you now use. They maintain highest levels of light over their long life.

Try High Efficiency Lamps in an entire work area. If you don't agree that you get more light—softer, more comfortable light—we will exchange them for any Westinghouse fluorescent lamps of your choice.

Order new "H.E." lamps today from your authorized Westinghouse Lamp Agent or nearest Westinghouse Lamp Sales Office. You can be sure . . . if it's Westinghouse.

Westinghouse

WESTINGHOUSE LAMP DIVISION
Westinghouse Electric Corporation, Bloomfield, N. J.

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OPERATION AND PRODUCTION®—pointers for the industrial plant engineer

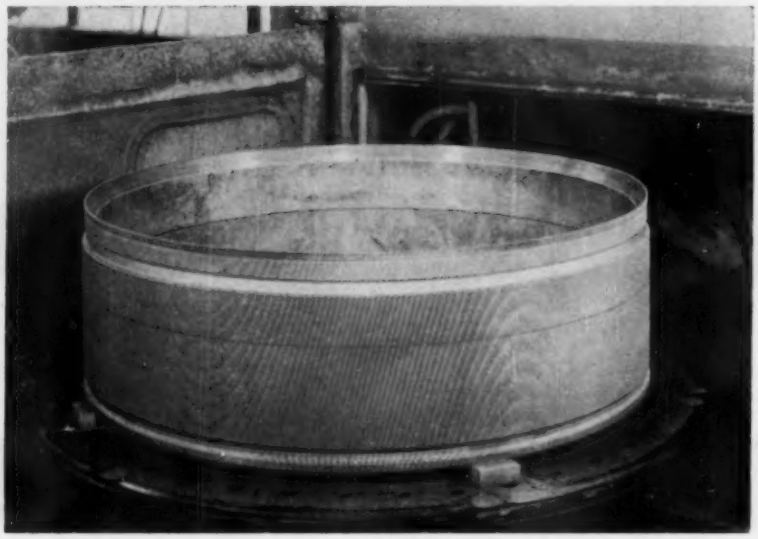
Edited by Vern Kempf

Wet Blast Cabinet Finishes and Deburrs Machine Parts in Only 39 Minutes

FINISHING and deburring knitting machine parts at Jacquard Knitting Machine Company, Inc., Philadelphia, is accomplished faster and more thoroughly in a specially designed wet blast cabinet than with manual blasting used previously.

As installed, the cabinet performs the complete finishing operation on a large cylinder in just 39 minutes. Up to three days were required previously. The knitting machine part is placed on a table bolted to the door.

All areas are now uniformly blasted automatically to remove fine machine burrs in the slots, round off leading edges of the slot and blend all directional lines. The wet blast equipment was made by the Techline Division of Wheelabrator Corporation, York, Pennsylvania.



Blast cabinet uniformly removes machine burrs in slots on this machine part.

Low Cost Unscrambler Performs Two Operations

HERE IS AN ingenious solution to a tricky little production problem used at Tacony File & Hardware Company, Philadelphia. The problem occurs at the delivery end of a belt conveyor handling a stream of small files coming from a heat-treating furnace and subsequent oil quench operation. Because of this some device was needed at this point to unscramble the files quickly, without risk of injury to the operator, and to also remove the oil still adhering to the files with a suitable solvent.

Vibrating feeder unscrambles files, helps perform degreasing operation.

Both of these aims were met by positioning the tray of a vibrating feeder, manufactured by Eriez Manufacturing Company, under the flow of files and installing a solvent spray above the tray. The vibratory action of the feeder causes the files to unscramble and move in a straight line up a 10 degree incline to the delivery point. The incline causes the degreasing solution to flow to the rear of the tray where a series of perforations allow it to be picked up for recirculation.

Baffle Cuts Tank Heating Costs

MAINTAINING pumping temperatures in four, 5000-gallon outside storage tanks was quite a problem at the Bel Ray Company, Inc., plant at Collingswood Park, New Jersey. As plant operations are of the batch variety, there is no point in keeping the entire contents of each tank at pumping temperatures when only a portion is needed at any given time.

To solve this problem, a 12-kw electric heater was installed in each tank to act as a suction heater. A baffle, two inches above the top of the manhole in each tank, concentrates the heat in a 300-gallon area near the bottom. This is the approximate amount of lubricant needed at a time and is always ready for use. When this amount is drawn off, it is replaced by a similar amount entering the heated area. The heating units were furnished by Hynes Electric Heating Company, Mountainside, New Jersey.

Air Cylinder Slide Gate Slices Lumpy Product

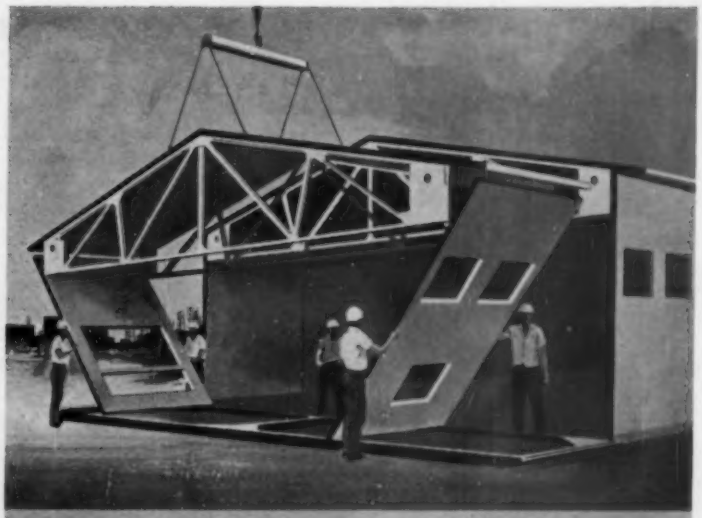
HANDLING powdered chemicals under difficult conditions is an everyday job at the Howard Fertilizer Company, Orlando, Florida. Thick dust and lumpy material can clog mechanical devices in a short while, causing costly downtime.

One potential trouble spot was the combined weigher-hopper where dry fertilizer ingredients are weighed before screening, mixing and bagging. At this stage of production, the operator selects any one of 12 ingredients from an overhead cluster bin. According to his mix schedule, the

(Continued on page 64)

Architects expanding uses for Aircomb®

Architects, contractors and plant engineers are making increasing use of the special advantages of *Aircomb* panels. The high strength-to-weight factor, durability and low maintenance of this versatile material have stimulated a wide increase in its use throughout the building industry. *Aircomb* is highly-uniform phenolic-impregnated Kraft honeycomb which can be bonded permanently to an almost unlimited variety of laminating materials as thin as .01". Your specifications may offer opportunities to use *Aircomb* for its unequalled combination of beauty, strength and easy installation.



AIRCOMB® BUILDING SYSTEM, *developed by Douglas, sets up special purpose buildings in hours. Structures are comprised of pre-fabricated, easily transportable Aircomb modular panels containing integral electrical and air systems. They can be sealed tight against air, dust and water under the toughest terrain and environmental conditions.*

COMMERCIAL BUILDINGS *built of structural Aircomb-cored panels — like this 4-year-old cafeteria in Compton, California — have shown outstanding durability and lasting beauty while requiring far less than average maintenance.*

OFFICE BUILDINGS, HOTELS AND DEPARTMENT STORES *are making increasing use of Aircomb panels for curtain walls, sunshades, etc. Aircomb sunshades are being used in this 45 story Humble Oil and Refining Co. building in Houston, Texas, designed by Welton Becket & Associates, Architects & Engineers. Aircomb-cored curtain walls are in the Southern Ohio Power and Light Company building, Columbus, Ohio, the Daniels and Fisher Department Store, Denver, Colorado, many others.*

DOUGLAS AIRCOMB PRODUCT

AIRCOMB®

A product of DOUGLAS AIRCRAFT COMPANY, INC.
3000 Ocean Park Boulevard, Santa Monica, California

For more facts circle 545 on Reply Card

OPERATION — PRODUCTION

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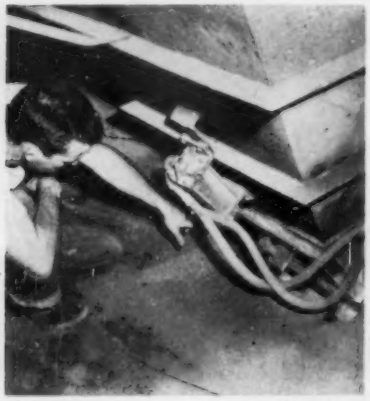
operator releases a flow of a particular powdered chemical into the weigher-hopper until the indicator registers the desired weight.

He then dumps the contents onto a belt conveyor by opening a gate built into the bottom of the hopper. Since



Air cylinder operates slide gate to cut lumpy material blocking opening.

it is practically impossible to keep the hopper area clean, careful consideration had to be given to selection of a device for opening and closing the hopper gate.

A dependable gate-opening system was obtained by using a Schrader air cylinder and four-way valve. A vibrator is installed on the side of the hopper to prevent a hang-up of material when the gate opens, but lumps of powdered chemicals occasionally clog the gate and interrupt free flow. When this happens, the operator works the air-valve handle back and forth. The air cylinder rapidly opens and shuts the gate, cutting up the lumps and empties the hopper.

Epoxy Solves Floor Problem

A CONCRETE FLOOR, containing a metallic hardener and with a compressive strength of 4000 psi, provides a serviceable surface for many industrial operations. But when the loads are aircraft engines, weighing as much as five tons and supported only by four, 3-in. crowned casters, the stress can be much greater. This was the case at Trans World Airline's 25-million dollar overhaul base at Kansas City, Missouri, where engines are moved about on transport stands to repair and test areas.

With the three-inch-wide crowned casters in essentially point-contact with the floor, the actual pressures are perhaps as much as 10,000 to 15,000 psi. As the surface roughens, the loaded wheels, falling from high to low points in the floor deliver short but punishing blows. This action further roughens the floor and a survey disclosed some pits and ruts nearly two inches deep.

For some time, TWA's engineers have been making extensive use tests with various resurfacing materials and methods. These included a number of high-density concrete products but none performed well enough to warrant its use.

Epoxy compounds were then in-

Prime coat of epoxy resin is swabbed on cleaned and etched concrete surface prior to troweling epoxy surface.

vestigated and found promising. After considerable test work, an epoxy system using products from two companies was selected as the best performer. In this system the resin is Bakelite Brand ERL-2795 produced by Union Carbide Plastics Company and the hardener used is Sonite EC, produced by the Smooth-On Manufacturing Company.

Before applying the resin the selected area is chipped down to solid concrete and cleaned and etched to provide a good bonding surface. A neat coat of an epoxy-hardener mixture is then swabbed on to act as a primer and to insure good bonding between the concrete and the final epoxy top coat. This is followed by a troweled coat composed of epoxy resin, hardener and fine, white flint sand aggregate. The troweled coat varied from one-eighth to two inches in thickness and was feathered out to original floor surface at edges.

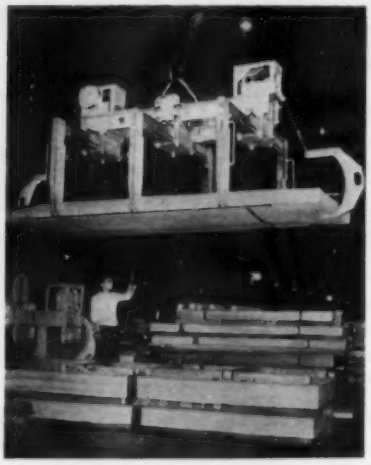
Curing was allowed to proceed at room temperatures with light traffic permitted in 24 hours and normal operations after three days. Materials and labor costs worked out to be approximately 45 cents and 65 cents, respectively, per square foot. The epoxy formulation used has a compressive strength of about 20,000 psi and is expected to have a long service life.

Compact Lifter Saves Space

PACKS of sheet steel, ranging from 18 to 60 in. wide, are handled quickly and safely with a motorized rack and pinion type sheet lifter at the Inland Steel Company's Indiana Harbor Works, near Chicago.

Designed and manufactured by the Materials Handling Division of Heppenstall Company, the lifter is used in Inland's galvanizing department for placing the packs in stacks and removing them when needed. It will accommodate loads up to 31 in. high and weighing up to 20,000 lb.

Designed primarily for loads up to



Straight line arm motion of rack and pinion lifter handles variety of pack widths but requires little headroom.

120 in. long, the lifter will accommodate even longer loads by the use of end grabs. The rack and pinion design was selected because it permits handling loads with great variation in width, but requires little headroom.

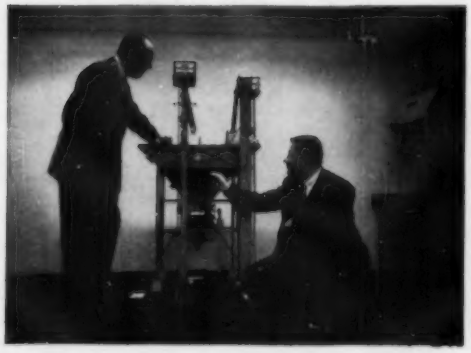
Lifting arms move in and out in a straight line and clearance of 14 in. on each side of the pack to be lifted is sufficient. Wooden 4 by 4's are

(Continued on page 66)

Bill St. John (left) with Heltzel Chief Engineer, W. J. Kirchner, who said: "As a result of Bill's recommendation, we're using Jeffrey's combination chain. It's economical, yet gives the needed strength in our higher elevators."

"Jeffrey gives us the kind of service we want"

Heltzel buyer, John Holodnak (right): "It's strictly service as far as Jeffrey is concerned with us. Jeffrey gives us quotations in two days or less. They stock for us. Delivery is no problem."



The Heltzel Steel Form & Iron Company, of Warren, Ohio, manufacturer of concrete batching plants, now looks to Jeffrey for power transmission components. Heltzel engineers and buyers agree that Jeffrey gives them the kind of service they want.

Commenting on Jeffrey service, Heltzel Chief Engineer, W. J. Kirchner stated, "Originally, Jeffrey's Director of Research came to Heltzel with Bill St. John (Jeffrey Northeast Ohio Sales Engineer). They sat down and discussed our needs—Bill knows what he's talking about. We understand each other. We have followed his recommendations in many instances."

Find out exactly how Jeffrey delivers the kind of service you ought to have. Arrange a meeting through the Jeffrey office nearest you, or contact: Manager, OEM Sales, The Jeffrey Manufacturing Company, 905 North Fourth Street, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

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makes PENNSYLVANIA COMPRESSORS run efficiently...silently...with minimum maintenance.

Stainless steel valve discs lift against a cushion of air in the simple, efficient design of the Air Cushion Valve that makes PENNSYLVANIA Compressors run so silently, so dependably, and with such low maintenance requirements. Air Cushion Valves have no nuts, bolts, or screws to break or burn fast. You get longer valve life . . . eliminate wear . . . eliminate noise caused by metal striking metal. Flat valve discs have no flexing or bending action to weaken or distort them. And the valve springs are highest grade stainless steel, rolled on edge, insuring maximum strength and durability. There is just one spring for each disc, and it bears evenly on the entire surface.

But this is only part of the PENNSYLVANIA story. Learn all the facts in "Compressors for Industry". It describes PENNSYLVANIA Compressors from 10 to 350 hp, horizontal, angle, and OILFRE models. Write to Dept. C-12 for your copy today.

PENNSYLVANIA
PUMP AND COMPRESSOR COMPANY
Easton, Pa. • Earning Customer Confidence Since 1920

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OPERATION—PRODUCTION

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used for vertical separation of the packs in a stack. This allows ample clearance for the lifting arms to move under a pack.

Raising and lowering of the lifter is controlled by the crane operator from his cab. The lifter is lowered over a pack with its arms opened wide enough for clearance. When it is positioned, the crane follower operates a pushbutton control causing the arms to close on the pack. A slip clutch in the motor drive prevents damage to the sheets and to the drive mechanism. A self-locking mechanical brake maintains the lifting arms in a fixed position.

Long Belt Reduces Splices

Coal conveyor belt, manufactured by B. F. Goodrich Industrial Products Company, measures 2360 ft in length and is 48 in. wide. One of the longest belts shipped in one roll, it stands 13 ft 10 in. high and weighs 40,000 lb.

Foil Reduces Ceiling Cost

MANUFACTURE of precision instruments requires control of a number of variables. Among the more important ones are lighting, temperature and contamination within the manufacturing facility itself.

Reflective aluminum foil insulation proved to be the best solution to provide these controls and do it economically. A type of aluminum foil insulation consisting of three foil sheets with the bottom sheet laminated to kraft paper backing was used in the construction. When this

A 15,000 lbs/hr unit in a boxboard plant

Boilers in various stages of completion in our shop

More Steam per dollar of investment with Vogt

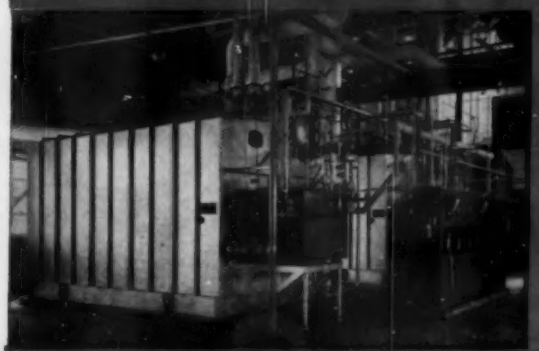
PACKAGE WATER TUBE BOILERS

Completely shop fabricated, with burners, controls and accessories installed before shipment.

Placed on a suitable foundation, only fuel, water, breeching and steam connections need to be made to place unit in operation. Vogt Package boilers are available in oil and/or gas fired types in standard pressures of 175, 250 and 375 pounds per square inch gage.

One of two 30,000 lbs/hr units for a hospital

This 18,000 lbs/hr unit is one of two for an office building



Two 25,000 lbs/hr units installed in a manufacturing plant

Write for literature Address Dept. 24A-BPLE

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Los Angeles.

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Where Dirt Could Mean DANGER...

North American Aviation plant, Downey, Calif.

Vacuum cleaning during the final assembly provides all-important "last minute" protection.

You'll find SPENCER Vacuum Systems

Built-in vacuum systems by Spencer are being relied on increasingly by industry to protect product quality during inspection and assembly.

In this "white room" at the Autonetics plant of North American Aviation, for example, a Spencer system is utilized for:

1. Frequent floor cleaning to maintain critical standards of dust-free cleanliness.
2. Final cleaning of components—by use of bench inlets at the individual assembly stations.

Whatever your needs in a built-in system—or industrial portable vacuum cleaners—it will pay to check with SPENCER . . . world leader in industrial vacuum cleaning equipment.

Request Catalog #155B

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

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OPERATION—PRODUCTION

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Exposed reflective aluminum insulation saves on paint and maintenance.

foil blanket is expanded, it forms four reflective air spaces which efficiently block radiation, convection and conduction. A continuing vapor barrier is provided by the kraft paper backing which also provides application support. The aluminum foil insulation used is called Alfol and is a product of Reflectal Corporation, a subsidiary of the Borg-Warner Corporation.

Insulation was stapled directly to the roof joists of the exposed ceiling and eliminated the need to paint the ceiling. With other types of insulation, a covered ceiling or supporting material is required to hold up the insulating material. These surfaces require painting and regular maintenance. The use of this reflective foil insulation saved approximately one third the cost of over-all finishing of the ceiling area.

Modified Cam Improves Machine

RAPID TRAVEL CAMS on screw machines at The Timken Roller Bearing Company, Bucyrus, Ohio, were revised to assure that the collet on each machine is open when the machine is out of stock and is automatically stopped. When the feeder shell closes, indicating there is no remaining stock, a cam actuates a switch which automatically stops the machine. During this action, the rapid travel cam is also actuated which opens the collet so the stock butt can be removed.

Before the revision, all power to the main cam drum was disengaged

Photo Courtesy of the Pierce Wrapping Machine Company, La Grange, Illinois

STROBOTAC *for Design Analysis*

Type 1531-A Strobotac® Electronic Tachometer and Motion Analyzer . . . $260.

U. S. Patent Numbers: 2,478,901; 2,478,907; and 2,492,142 Patent Pending; Patent Applied For. Licensed under designs, patents and patent applications of Edgerton, Germeshausen and Grier.

This toroidal winding machine for the spiral wrapping of tires, steel coils, rugs, and other products was designed with the aid of the Strobotac. Only under stroboscopic light could the intricate behavior of the wrapping mechanism be studied as the paper was being wound.

In the design of machinery of this type there is no better way to determine whether the various machine parts are operating as planned than to watch the progress in "slow motion" under stroboscopic light. The Strobotac's high-intensity light flashes of a few microseconds duration reveal flaws or machine eccentricities as no other equipment can. The Strobotac also serves as a handy device for speed measurements to 250,000 rpm and above.

Strobotac features which Pierce Wrapping's Chief Engineer indicates are advantageous in his work include:

"The high-intensity white light enables measurements to be made under normal plant lighting, eliminating the need for a previously used darkened room."

"Greater stability of the new Strobotac eliminates the necessity of continuously jiggling the dial to keep the machine synchronized."

"Simplified dial and range-switch arrangement for easy reading."

"The multi-position reflector and lamp can be easily moved around and pointed to best advantage at the inside of the machine without the necessity of repositioning the entire instrument."

"The very well-designed case allows you to close up the unit at a moment's notice and leave it in the shop, while you go back to Engineering to do a little calculating."

CHECK THESE SPECIFICATIONS and see how the new Strobotac will aid you in design and analysis of machine operations — whether it be rotating, reciprocating, or any type of cyclic movement.

Intense, white-light — more than 70 times brighter than previous model.

Extremely short duration flash (1 to 3 μsec) practically eliminates blur — "freezes" motion — shows details heretofore impossible to see.

Measures speed directly with ±1% accuracy to 25,000 rpm — useful to at least 250,000 rpm.

Long-throw beam reaches into the heart of complex machinery — made possible by new flash tube developed exclusively for this instrument.

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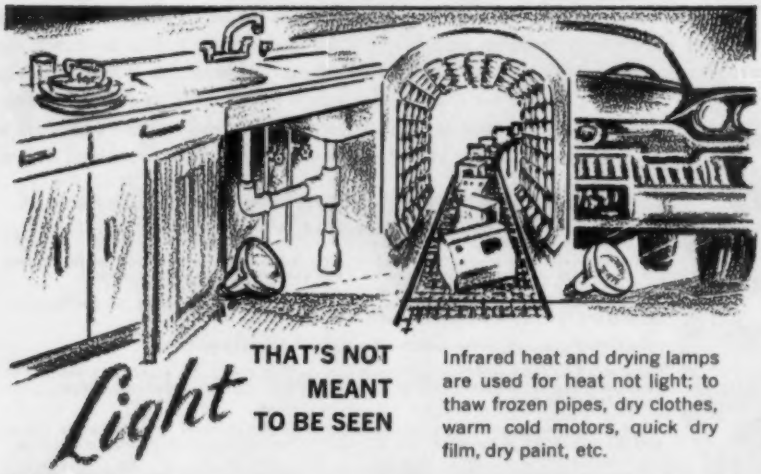
The eyes of insects are less attracted to yellow light than white light — a fact which makes yellow "bug" lamps desirable illumination for outdoor living.

Incandescent lamps made for outdoor use are protected from rain, snow, heat, and cold by glass which can withstand abrupt temperature changes — similar to the glass used in household baking dishes.



Light THAT'S NOT MEANT TO BE SEEN

Infrared heat and drying lamps are used for heat not light; to thaw frozen pipes, dry clothes, warm cold motors, quick dry film, dry paint, etc.

THERE ARE OVER 3,000 types OF CHAMPION LAMPS FOR INDUSTRIAL AND COMMERCIAL USE

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

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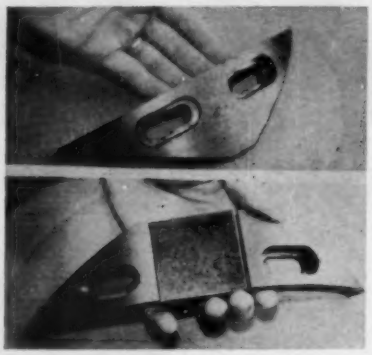
when the machine was out of stock. The drum stopped with a minimum of coasting but the exact position of the cam depended upon how fast the power was removed. The variable adjustment of the high speed disc clutch altered the time it disengaged. As a result, the machine often stopped before the chuck fully opened. It was then necessary to jog the machine to a point where the chuck would open and the stock stop could be raised.

Revision of the rapid travel cam



Rapid travel cam, above, was split and spacer added, below, to keep collet open so stock can be removed.

consisted of splitting the cam and adding a spacer. This spacer permits the cam to keep the collet open so the stock butt can be removed. The feature permits the kinetic energy of the large drive pulley to be transmitted through the gear train to the cam drum shaft after the electric motor has lost energy. The cam drum will coast until the chuck opens and the brake stops the cam shaft.

Pit Conveyor Lifts for Cleaning

A SPECIALLY designed retractable stainless steel belt conveyor was recently installed at Star Kist Foods, Inc., Terminal Island, California, for handling tuna waste. The belt is made of a strip or band of stainless steel, specially trued and flattened.

During normal operations, the conveyor runs under the floor in a retracted position. It travels at right angles to eight cleaning table conveyors and carries tuna waste to a point outside the plant.

A formerly used screw conveyor

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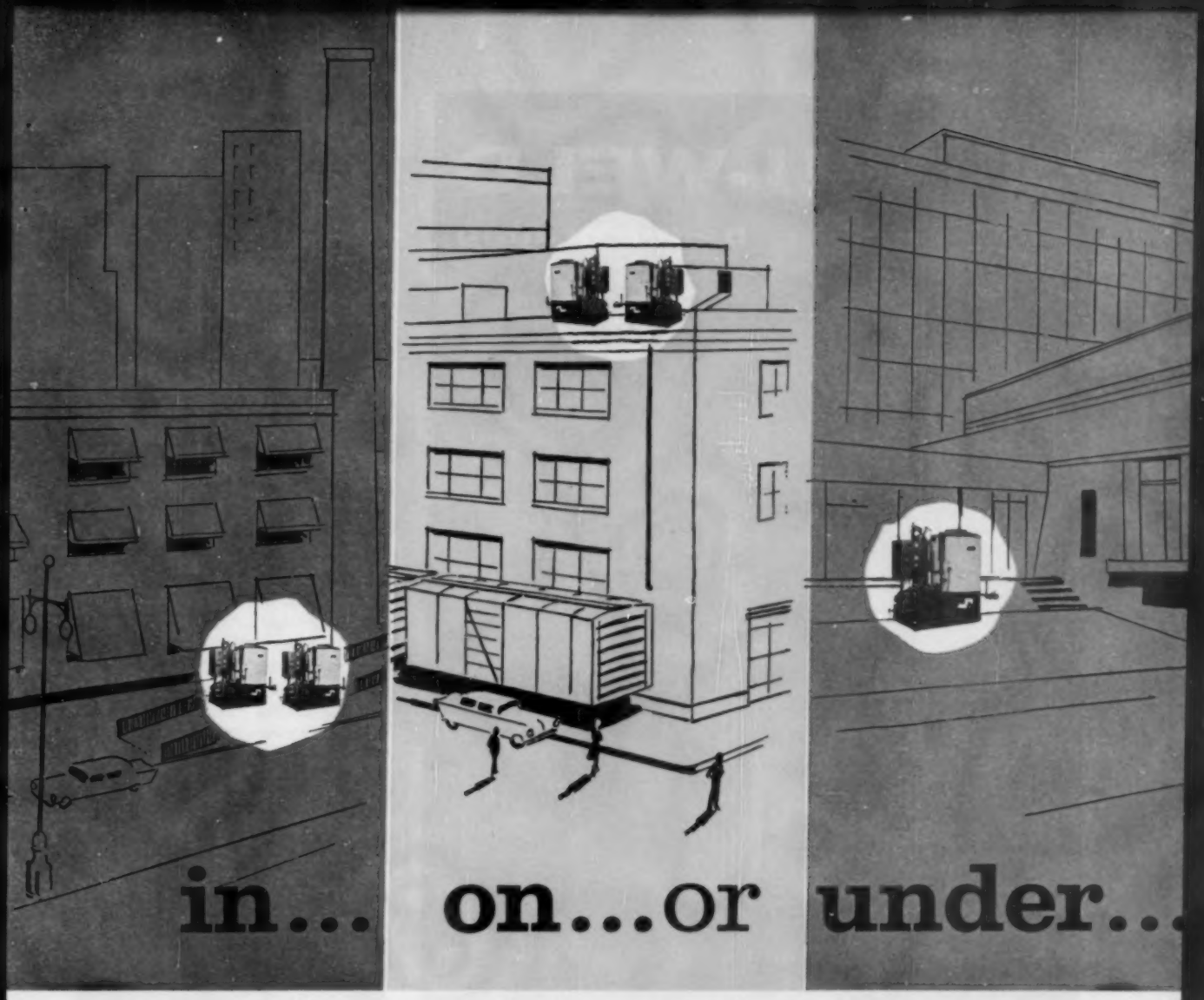
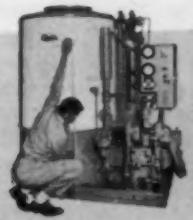


Leading beverage company proves "Steam The Modern Way" saves space

Illinois plant installed two 100 HP Claytons IN old smokestack ash pit, releasing many sq. ft. for plant expansion. Louisiana facility placed two lightweight Claytons ON the roof. California plant located Claytons easily UNDER loading dock.

This, indeed, is "Steam the Modern Way"... a 175 HP Clayton takes just 4 ft. x 7 ft. of floor space, stands just 8 ft. high. Write for full information on how Claytons can solve *your* space problems.

423



175 HP

Clayton

Steam Generators

Clayton Manufacturing Company

463 No. Temple City Blvd., El Monte, Calif.

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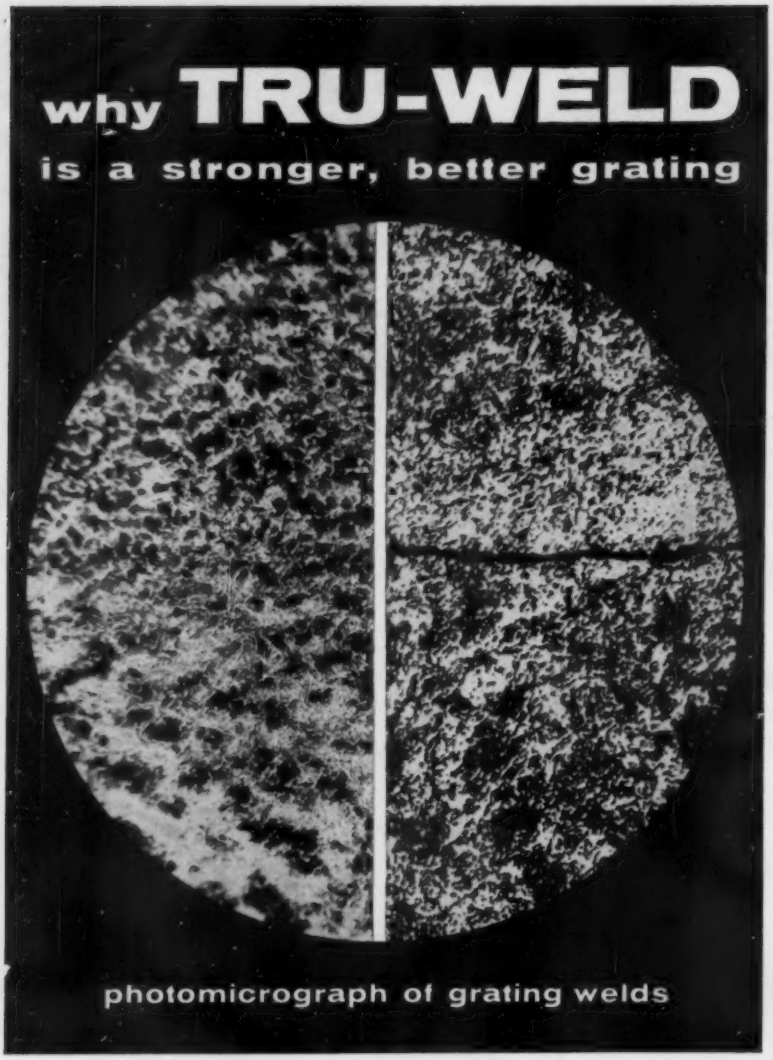

This enlargement of the weld area in TRU-WELD grating shows how solidly the metals have joined. Cross bar and bearing bar have fused into a strong, moisture- and vibration-proof weld.

Enlargement of an incomplete weld area. Note the line of separation between bearing bar and cross bar. Heavy traffic and vibration can easily separate such a weld.

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more.*

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating, call the Dravo representative in your area, or write DRAVO CORPORATION, PITTSBURGH 25, PA.

DRAVO
CORPORATION
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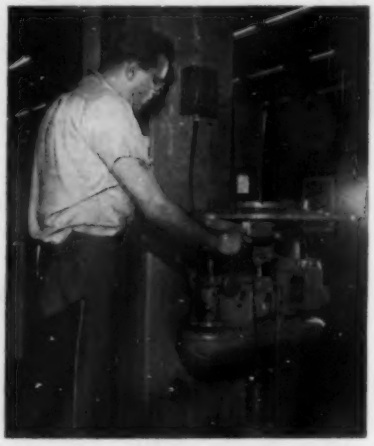
ground the waste product into an oily substance and made it difficult to handle at the by-product plant. The flat steel belt, furnished by Sandvik Steel, Inc., Fair Lawn, N. J., eliminates this grinding problem.

Measuring 171 ft between terminal centers, the conveyor is 32 in. wide and 0.032 in. thick. The enclosure pit is four feet wide and tapers from five to seven feet deep. The conveyor is raised out of the pit for cleaning by means of two hydraulic cylinders anchored to the take-up end of the pit wall, one on each side of the conveyor frame.

The conveyor is connected to the supporting structure at 20 ft intervals by linkages and all the links are connected to the hydraulic cylinder by push rods. When the hydraulic cylinder is operated, both the conveyor and covering grating rise above the floor to simplify cleaning operations.

Upside Down Drill Speeds Work

MOUNTING a rotary table over a standard 17-in. Delta drill press, inverted on its column, makes it easy



Upside down drill press lets operator get closer to work when spotfacing.

for the operator to spotface bolt holes on the outer edge of aircraft engine mounting plates. The setup, used at United Air Lines' Engineering and Maintenance Base, San Francisco, enables the operator to get closer to the work. The drill press column has been shortened to permit mounting of the table without interference.

Read this . . . Order this . . . Install this . . .

Save up to ⅓ the cost of your next conveyor with Handidrive components

Why pay big premiums for unnecessary custom engineering? Order your next conveyor mail order style . . . right out of STANDARD CONVEYOR's new *Handidrive* Handbook. Get fast delivery right off the shelf . . . save up to ⅓ the usual cost.

How? Using this valuable new Handbook, you can plan your own installation, order the components you need from factory stock, and then assemble them yourself with simple tools to save on erection costs. And, should you need help, our conveyor specialist in your city will be happy to give free advice on layout, ordering, prices and installation.

In-stock *Handidrive* components include gravity and power roller sections, belt sections, drive units, curves, supports, hangers, tapered sections, guardrails, feed sections, diverters —everything you normally need for an efficient, low-cost conveyor installation.

Moreover, all components are interchangeable to simplify future alteration of your *Handidrive* system to meet changing material handling requirements.

Check these Standard-ized Handidrive "right-off-the-shelf" benefits

- Lower initial cost . . . you buy only what you need!
- Inexpensive to alter or add to.
- Stock items cost us less to build . . . cost you less to buy!
- The most complete line of fully integrated units all from a single source.
- Ready to ship as fast as we can process your order!

Here's the Handbook *that tells you exactly what to do to cut costs with pre-engineered HANDIDRIVE conveyors. Send for your free personal copy now. Just fill in the coupon, attach to your letterhead and mail. Do it today!*

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Look in your Yellow Pages under "CONVEYORS"

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Please send me your new HANDIDRIVE Conveyor Handbook.

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Industry-proved through a quarter century of service...THERE'S NO DOUBT ABOUT NEOPRENE

ROUGH TREATMENT

another ex-enemy of portable cord... thanks to neoprene jacketing

There is only one place to test a product's ability to withstand the abrasion and physical abuse of in-plant operating conditions. That's on the job, in hard service.

And on the job is where neoprene cable jacketing has *proved* its ability to protect portable cords from gouging, tearing, abrasion and impact. In industrial plants, in the oil fields, and in coal mines, cables jacketed with neoprene have demonstrated their wearability time and time again.

On top of this excellent physical durability, neoprene synthetic rubber jacketing offers resistance to oils, chemicals, ozone, weathering, heat and sub-zero cold. No other jacketing material has such a versatile combination of properties. No other jacketing material has been so thoroughly proved in actual service. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department PE-12, Wilmington 98, Delaware.

DU PONT NEOPRENE

Better Things for Better Living . . . *through Chemistry*

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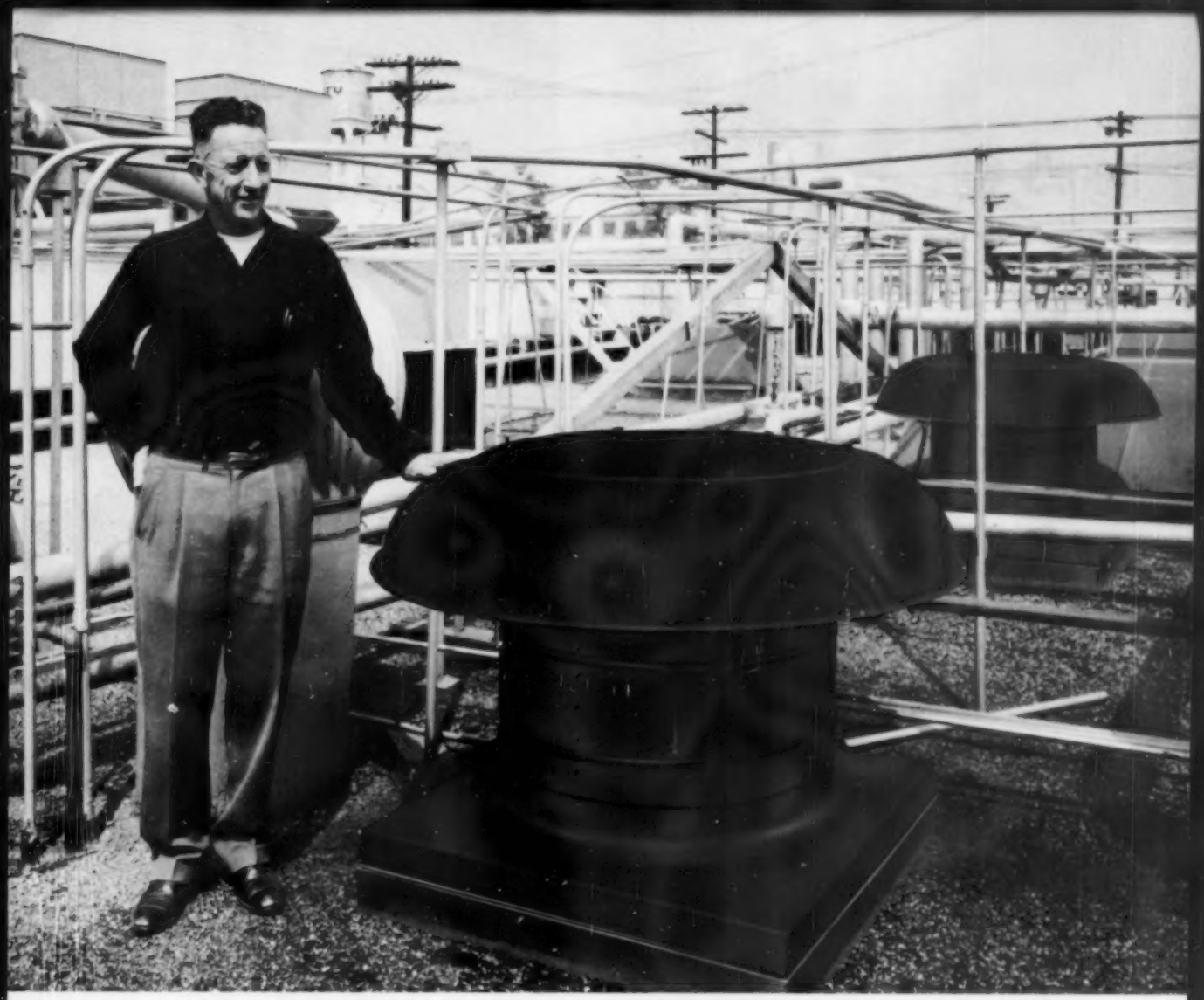

"These two Ilg units give us proper vat ventilation"

...Meadow Gold Dairies, Pasadena, Calif.

"We'd have been better off if we'd put in these two Ilg power roof ventilators a long time ago," says John McKinley, plant engineer, Meadow Gold Dairies, Pasadena, California.

"Our problem was to increase ventilation over some vats in our ice cream mix room. We had a centrifugal fan but it didn't handle enough air.

"So we put in these Ilg roof ventilators and solved our problem. They exhaust the steam from our vats plus 'dust' from various powdered ingredients we dump into our mixers.

"Wish we'd talked to your salesman a long time ago."

ILG

ILG ELECTRIC VENTILATING CO.

2832 N. Pulaski Road, Chicago 41, Ill.
Offices in 60 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

Here's why power roof ventilators and fly fans satisfy customers

Low in Height . . . High in Performance. Ilg Type LSQ power roof ventilators feature direct-connected, patented "Q" fan wheels that pass air over blade smoothly, quietly. Low-starting torque of Ilg 3-phase and permanent-split capacitor, single-phase motors eliminates starting shock, lengthens fan life. Eleven sizes for exhausting from 87 to 21,000 c.f.m. . . . at pressures from 0" to ⅜".

"Ain't No Flies on Us." New Ilg B-15FF fly fans above receiving-room doors at Meadow Gold Dairies solve the fly problem. Powerful down-blast of air forms a protective screen that blocks out all insects.

"Check-Out" Time: Every Ilg-built Type "Q" fan wheel passes rigid dynamic balancing checks and tests before being direct-connected to Ilg-built totally-enclosed, 3-phase or permanent-split capacitor, single-phase motors. This Ilg Type "Q" fan wheel design is unmatched for quiet, efficient operation.

ILG ELECTRIC VENTILATING CO.

2832 N. Pulaski Road, Chicago 41, Ill.

Offices in 60 Principal Cities

Member of Air Moving and Conditioning Association, Inc. (AMCA)

Bigger... more rewarding than ever

the 1961 National PLANT MAINTENANCE & ENGINEERING SHOW and CONFERENCE

PM&E

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AT THE SHOW . . .

4 days of exhibits . . . by over 350 companies.
Thousands of new products and services . . . all designed to increase plant-operating efficiency.

AT THE CONFERENCE . . .

34 basic subjects up for discussion . . . by over 50 speakers, all experts in their fields. Hundreds of new IDEAS—FACTS—TECHNIQUES to help you on the job.

You could spend months "at home" in talking to suppliers, and never see or know about more than a fraction of the products and services on exhibit at the 1961 Plant Maintenance & Engineering Show. Over 20,000 plant executives and engineers will be on hand to profit from this twelfth annual "show-of-shows." If your responsibilities bear on efficient plant maintenance and engineering, *your company needs you in Chicago in January.* And make your trip *doubly rewarding* this year by attending Conference sessions as well as Show exhibits.

Full information on any subject pertaining to the Plant Maintenance & Engineering Show & Conference is immediately available from Clapp & Poliak, Inc. at the address below.

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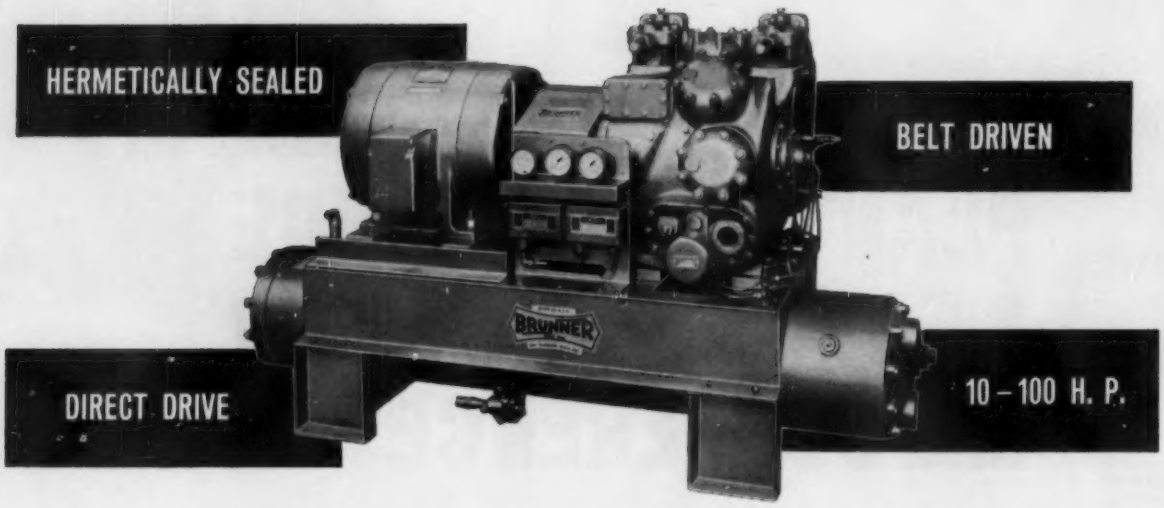
Instruments, Meters, Gauges
Inventory and Work Control Systems
Lubricants and Lubricating Equipment
Maintenance Tools and Supplies
Management Services
Materials Handling Equipment
Paint and Painting Equipment
Plant Furniture and Accessories
Plant Protection Equipment
Plumbing Equipment
Pollution Control Equipment
Power Generation and Distribution Equipment
Power Transmission Equipment
Product Finishes and Equipment
Safety Equipment
Sanitation and Cleaning Equipment
Storage Equipment
Welding Equipment

BRUNNER
SINCE 1906

MULTI-DRIVE...

A UNIT FOR EVERY NEED

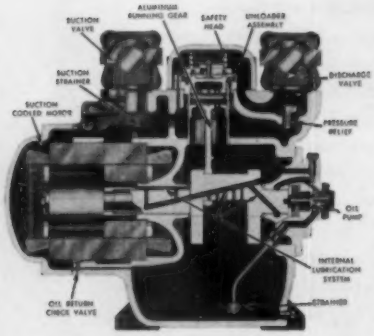


For refrigeration and air conditioning, you can select the unit you want and need . . . you're not compelled to compromise on what's available . . . when you specify a BRUNNER Multi-Drive compressor or condensing unit.

Ranging from 10 H.P. through 100 H.P. these units offer a selection which permits unlimited flexibility in specifying.

Direct drive, hermetically sealed and belt driven models are available. Interchangeability of components keeps replacement part needs at a minimum. Aluminum pistons and connecting rods, integral lubrication system, built-in capacity control and oil failure switch are just a few of the superior design and features which are standard on these units.

And behind every Brunner product is the peace of mind reassurance represented by over 50 years experience in the design and manufacture of quality compressors.



Hermetic compressors of the Multi-Drive line range in capacity from 10 H.P. to 100 H.P. and use R-22 refrigerant. Temperature ranges are from 10° to 50°F. Features include a motor stator that can be conveniently removed without the use of special tools, a safety device specifically designed to automatically trip all three phases of current as a protection against motor burnout, and suction cooled motor windings which maintain lower temperatures and assure longer motor life.

DUNHAM-BUSH

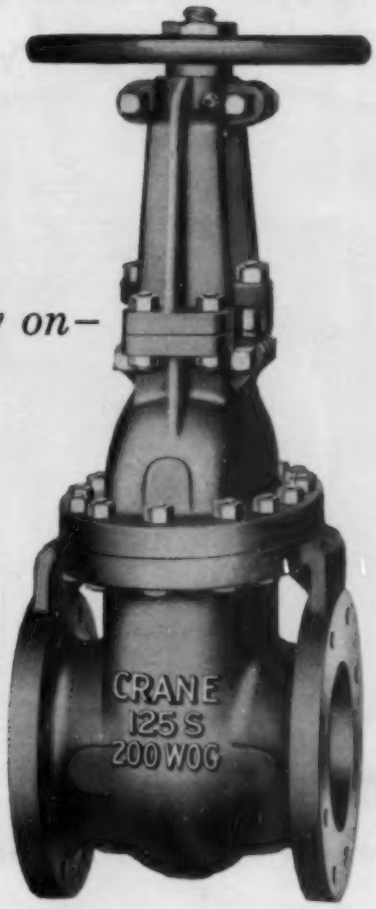
DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

For more facts circle 558 on Reply Card

The valves most plants rely on–



No. 465½,
125-pound iron body
gate, bronze trimmed.
Sizes 2" to 48".

CRANE 125-POUND IRON BODY GATES

On general utility services . . . water mains and distribution lines . . . low-pressure steam and hot water . . . air and gas . . . more plants rely on Crane No. 465½ iron body bronze trimmed gates than on any other valve in this class.

Crane iron gates are an up-to-date design with service-proved features. A two-piece, ball-type packing gland for bind-proof packing adjustment . . . shoulder-type seat rings that won't loosen . . . extra-long disc guides to minimize drag on seating faces. All features are carefully planned to yield long, dependable operating life.

To enable you to standardize on these economical, efficient valves, Crane builds them in a full range of sizes. Popular sizes are available from local stocks of your Crane Distributor.

CRANE®

Crane Co., Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Illinois

VALVES • ELECTRONIC CONTROLS • PIPING • PLUMBING • HEATING • AIR CONDITIONING

For more facts circle 559 on Reply Card

THESE ADVANTAGES MAKE "BLH" YOUR BEST BUY FOR

HEAVY-DUTY AIR HANDLING

- **High efficiency over a broad range of operation** — ideal for supplying ventilation and air conditioning systems.
- **Stable performance** over the entire range of operation — dependable delivery.
- **Handles pressures up to and including Class IV applications.**
- **Capacities up to 500,000 cfm** and over — in closely graduated sizes to permit exact selection for the job.

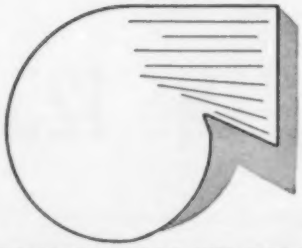
"Q" Factor* Features Available Only in Buffalo Designs

EFFICIENCY AT INLET

Cross-section of inlet, showing smooth half-circle passage into wheel formed by curved inlet bell and mating wheel flange. There are no flat spots to cause turbulence.

EFFICIENCY IN THE WHEEL

Showing deep, backward curve of blades in "BLH" wheel for smooth, quiet handling of air spun into the wheel in the direction of rotation. No waste turbulence.



EFFICIENCY THRU THE HOUSING

Not only is the "BLH" housing streamlined throughout, but its unique fared outlet delivers air to discharge duct with easy, gradual enlargement for best distribution and static conversion.

Write for new Bulletin F-201 for full details.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

For more facts circle 560 on Reply Card

MULTIPLY ECONOMY by 5

When You Install Buffalo Pumps

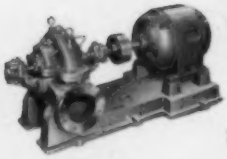
1 **Maximum parts interchangeability** reduces inventory costs.

2 **Emphasis on quality** insures extra years of economical, productive service.

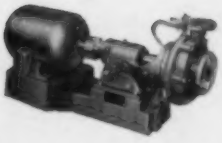
3 **Peak hydraulic efficiency** insures lower operating costs.

4 **Sturdy, extra-heavy construction** means trouble-free performance.

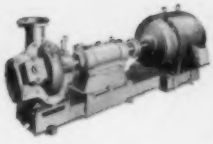
5 **Complete Buffalo line** gives one-source buying.



Clear Water Pumps. For peak efficiency in clear water service. Highest quality construction assures long, maintenance-free life. Write for Bulletin 955.

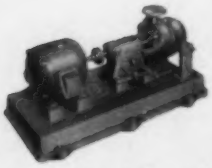


Chemical Liquid Pumps. These specially designed pumps stand up under the severest service, handle most types of corrosive or abrasive liquids. Choose from numerous models in exactly the trim you need. Send for Bulletin 976.



Non-Clogging Pumps. Efficiently move high consistency liquids. The diagonally split shell gives easy access for inspection. Rubber-lined models for moving abrasive or corrosive liquids. Send for Bulletin 953.

High Pressure Pumps. Designed for boiler feed and other clear water installations. These rugged pumps assure peak efficiency, minimum downtime and long life. Operate against heads to 1500 ft. Capacities to 900 gpm. For complete details request Bulletin 980.



Heat Transfer Pumps. Specially designed to handle high temperature liquids. Construction includes required alloys, water-cooled bearings and packings suited to the job. High-efficiency single suction, solid shell design. Write for full information.

Close-Coupled Pumps. Save space without sacrificing efficiency. Installation is simplified, no need for shaft alignment. Vertical or horizontal installation. Discharge adjustable to desired angle. Send for Bulletin 975.

Helping you select the pumps that will serve you best and most economically is your Buffalo Representative's job. Contact him today, or write us for complete facts.

"Buffalo" PUMPS

BUFFALO PUMPS DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canada Pumps Ltd., Kitchener, Ontario

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

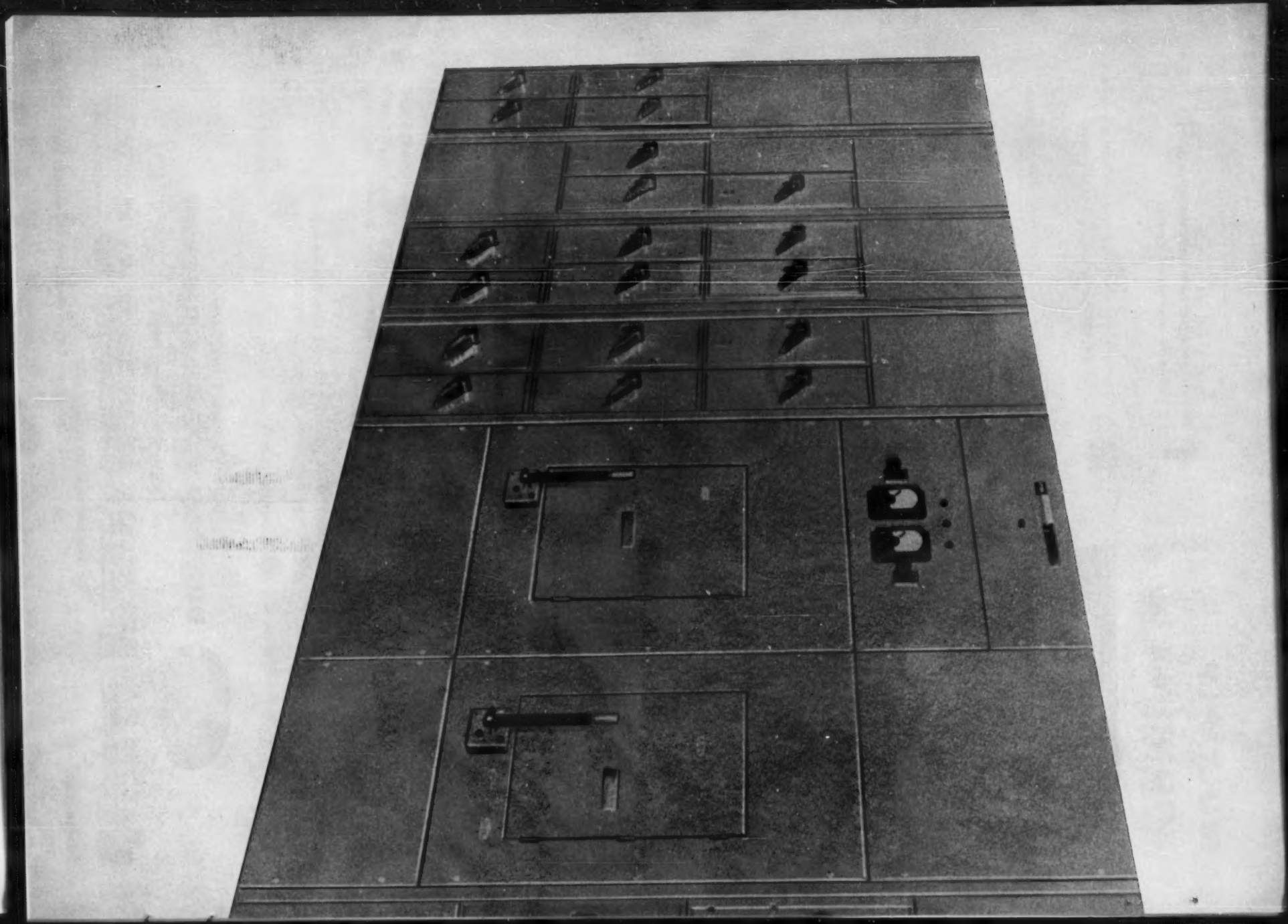
'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

For more facts circle 561 on Reply Card

For more facts circle 562 on Reply Card ⟶



why can't everybody build switchboards like this?

The answer is simple: only Federal Pacific has the Rotary Handle QMQB fusible switch units with visible blades... with the high-current capacity of a circuit breaker... with the 200,000 ampere interrupting capacity of fuses. Some manufacturers still use welded angle frames of 16 or 14 gauge steel plates. Federal Pacific utilizes bolted channel construction of 11 gauge steel for maximum strength and rigidity. What's more, Federal Pacific switchboards are designed on the modular principle: when you need to control more power, you can add units or entire sections — quickly and easily. Look again at the switchboard shown! It looks as new on the outside as it is on the inside—thanks to the Raymond Loewy design—exclusive with Federal Pacific. And if you think all this costs more, you're in for a pleasant experience when you contact your Federal Pacific representative. Write for Bulletin 2100, Dept. FP-7, Federal Pacific Electric Co., Newark 1, N. J.

FEDERAL PACIFIC ELECTRIC COMPANY

FPE

growth through creative energy

For more facts circle 562 on Reply Card

Armstrong announces Armaflex 22 —a new, improved pipe insulation

An improved flexible foamed plastic pipe covering, with a broader temperature range and a super-smooth surface finish, has been developed by Armstrong.

This easy-to-apply insulation can be used on hot lines operating up to 220° F., as well as on all cold piping at temperatures down to zero and below. The new, smooth surface gives every installation a neatly finished look.

In addition to being an efficient insulator, Armaflex 22 has high resistance to water and vapor penetration, is self-extinguishing, ozone resistant, and has negligible odor.

Armaflex 22 is made in 6-ft. lengths, in ⅜", ½", and ¾" wall thicknesses for pipe and tubing from ⅜" to 3⅛" i.d.

For free booklet on Armaflex 22, write Armstrong Cork Company, 2203 River Road, Lancaster, Pa.

COMPARISON CHART
Here's how the physical properties of Armaflex 22 compare with other flexible foamed plastic pipe coverings.

Physical Properties	Armaflex 22	Brand A	Brand B	Brand C	Brand D
Low Density less than 7.5 lb./cu. ft.	Yes	No	Yes	Yes	Yes
Low Water Vapor Transmission less than .15 perm	Yes	No	No	Yes	No
Low Water Absorption less than 3% by volume — 28 days	Yes	No	No	Yes	Yes
Dimensionally Stable at 220° less than 5% lineal shrinkage — 28 days	Yes	No	No	No	No
Dimensionally Stable at 200° less than 5% lineal shrinkage — 28 days	Yes	Yes	Yes	No	No

Properties evaluated at Armstrong Research and Development Center

Armstrong INSULATIONS

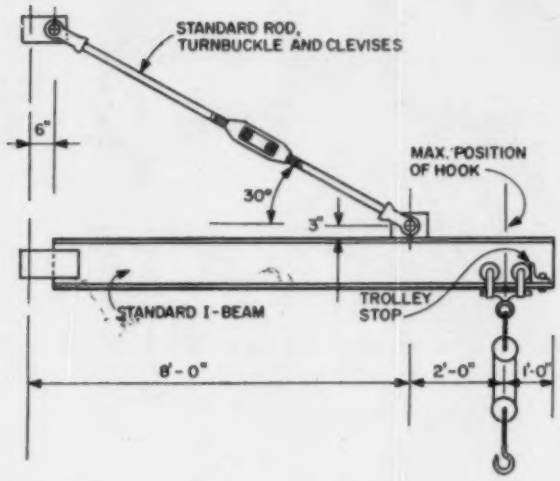
1860-1960 Beginning our second century of progress

For more facts circle 563 on Reply Card

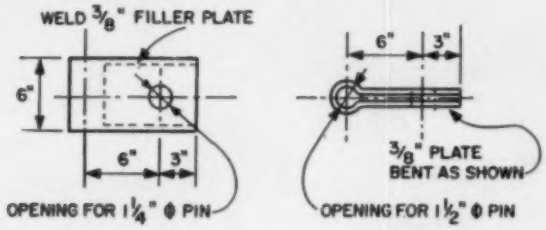
CONSTRUCTION BRIEFS —a review of fundamentals for the plant engineer

Prepared by B. A. Wasil, Structural Engineer

DESIGN OF A JIB CRANE
PART TWO

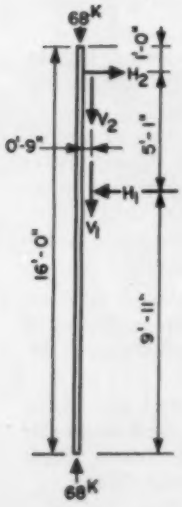


7. Detail of Column Clevis Connection



COLUMN REINFORCING

1. Loads



Case 1. Trolley closest to left

$V_1 = 4.64$ kips

$V_2 = 0.66$ kips

$H_1 = 1.15$ kips

$H_2 = 1.15$ kips

Case 2. Trolley closest to right

$V_1 = -1.33$ kips

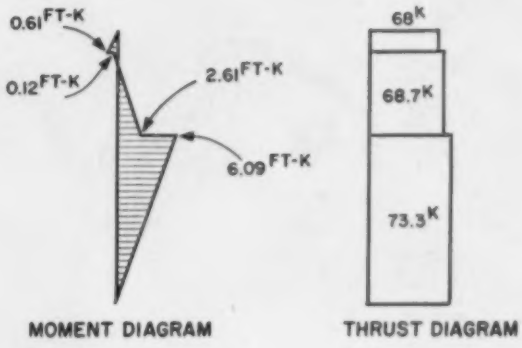
$V_2 = 6.63$ kips

$H_1 = 11.48$ kips

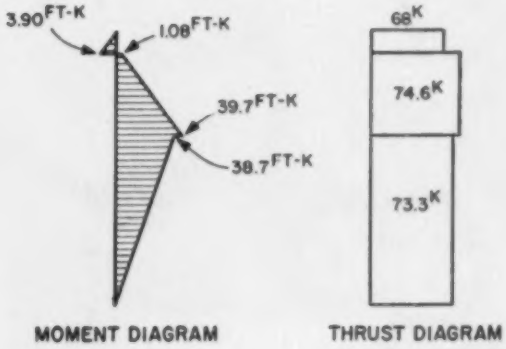
$H_2 = 11.48$ kips

2. Moments and Thrusts

Case 1.



Case 2.

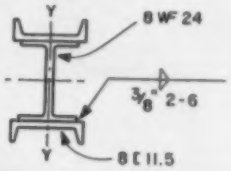


Controlling condition:

$M = 39.7$ ft-kips $\quad P = 74.6$ kips

3. Design of Column

Try 8 in., 11.5 lb channel:



$I_{y\text{-}y} = 18.2$ in.^{4} (I-beam) $+ 2 \times 32.3$ in.^{4} (channel) $= 82.8$ in.^{4}

$C = 4$ in.

$A = 7.06$ in.^{2} (I-beam) $+ 2 \times 3.36$ in.^{2} (channel) $= 13.78$ in.^{2}

$$\text{(least) } r = \sqrt{\frac{82.8}{13.78}} = 2.46 \text{ in.}$$

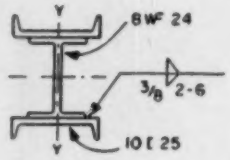
$$\frac{Ld}{bt} = \frac{16 \times 12 \times 8}{2 \times 0.413 \times 2.43} = 767; \quad f_b = \frac{12{,}000{,}000}{767} = 15{,}650 \text{ psi}$$

$$\frac{L}{r} = \frac{16 \times 12}{2.46} = 78.0; \quad f_a = 14{,}050 \text{ psi}$$

$$\therefore \frac{39{,}700 \times 12 \times 4}{82.8 \times 15{,}650} + \frac{74{,}600}{13.78 \times 14{,}050} = 1.472 + 0.386 =$$

$1.858 > 1.000$; N.G.

Try 10 in., 25 lb channel



$f_{y\,y} = 18.2 \text{ in.}^4$ (I-beam) $+ 2 \times 90.7 \text{ in.}^4$ (channel)
$= 199.6 \text{ in.}^4$

$C = 5$ in.

$I_{x\,x} = 109.7 + 2 \times 3.4 + 2 \times 7.33 \times 4.62^2$
$= 426.5 \text{ in.}^4$

$A = 7.06 \text{ in.}^2$ (I-beam) $+ 2 \times 7.33 \text{ in.}^2$ (channel)
$= 21.72 \text{ in.}^2$

(least) $r = \sqrt{\frac{199.6}{21.72}} = 3.03$ in.

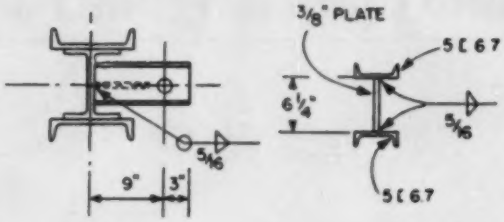
$$\frac{Ld}{bt} = \frac{16 \times 12 \times 10}{2 \times 0.436 \times 2.886} = 763 \quad f_b = \frac{12{,}000{,}000}{763} = 15{,}720 \text{ psi}$$

$$\frac{L}{r} = \frac{16 \times 12}{3.03} = 63.3 \qquad f_a = 15{,}060 \text{ psi}$$

$$\frac{39{,}700 \times 12 \times 5}{199.6 \times 15{,}720} + \frac{74{,}600}{21.72 \times 15{,}060} = 0.760 + 0.228 =$$

$0.988 < 1.000$, OK

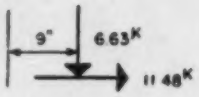
4. Column Jib Hinge Detail



Check (using maximum conditions)

$M = 6.63 \times 9 = 59.6$ in. kips

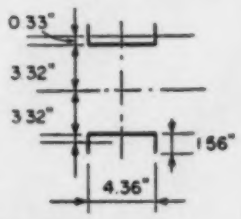
$I = 2 \times .48 + 2 \times 1.95 \times 3.62^2$
$= 51.1$



$C = \frac{6.25}{2} + 1.58 = 4.71$ in.

$$f = \frac{59{,}600 \times 4.71}{51.1} = 5500 \text{ psi} < 20{,}000 \text{ psi; OK}$$

Check weld Allowable stress, 5/16-in weld, 3000 lb per in.



Total length of weld $= 4 \times 1.56 + 2 \times 4.36 = 14.96$ in.

$I = 2 \times 7.48 \times 3.65^2 = 186.5 \text{ in.}^3$

$$\frac{59{,}600 \times 4.88}{186.5} + \frac{11{,}480}{14.96} + \frac{6{,}630}{14.96} = 2770 \text{ lb per in.}$$

$2770 < 3000$ lb. per in.; OK

IMPORTANT NOTICE ON FUTURE CONSTRUCTION BRIEFS

This Construction Brief, which concludes the two-part series on the design of a jib crane, also concludes the Briefs currently scheduled. For the past six years, PLANT ENGINEERING has presented these bi-monthly articles, dealing with the theory and mathematics of structural design.

The Briefs will be continued, but in our efforts to keep our readers abreast of the latest in materials and techniques, we intend to change the format. In future pages of this series, we will present those building ideas, materials, systems and methods that are the "progress reporters" of the construction industry.

Industrial construction will be stressed, but as new ideas come out of commercial and institutional building, we will present them as they might be adapted to the design and construction of your new plant.

So, in the February 1961 issue of PLANT ENGINEERING, look for the 'new' Construction Briefs!

The Construction Briefs that have been published since 1954, covering the theory of structures, as well as many practical problems in column, beam, truss and purlin design, are available in reprint booklets. The whole series, in six booklets, is priced at $3.50. Individually listed as to content and price, they look like this:

Booklet No. 1—Beams, Reactions, Bending Moment, Shear, Moment of Inertia, Section Modulus ($0.50).

Booklet No. 2—Deflection, Horizontal Shear, Practical Applications, Floor Loading, Framing Columns ($0.50).

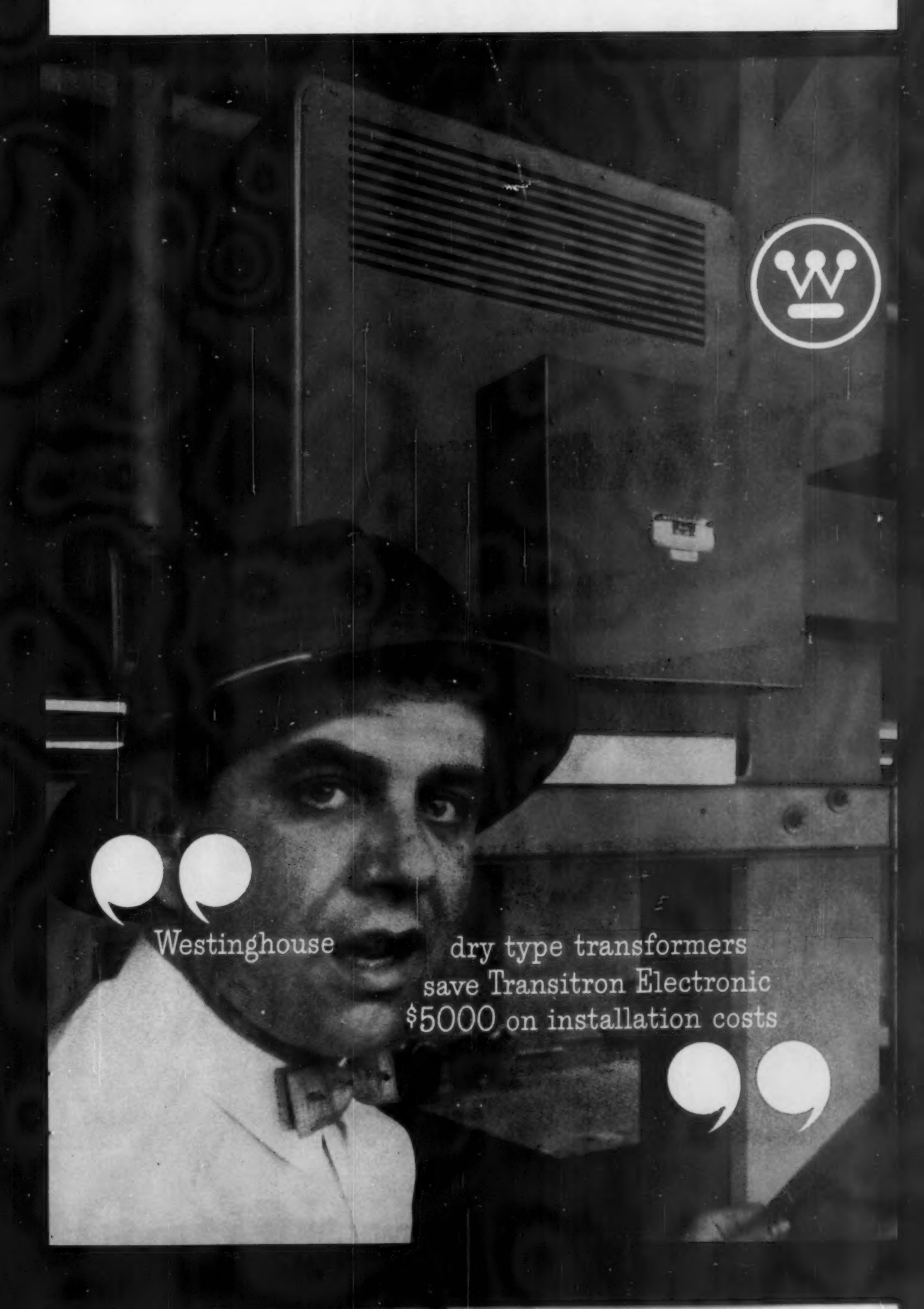
Booklet No. 3—Columns, Trusses, Connections, Welded Connections ($0.50).

Booklet No. 4—Fastenings for Timber, and Parts I through IV of the series "Structural Design of an Industrial Building ($0.50).

Booklet No. 5—Designing in Reinforced Concrete ($0.75).

Booklet No. 6—Design of Reinforced Concrete Columns, Design of Concrete Footings, and Design of Retaining Walls ($0.75).

We'll be glad to send you any or all of these booklets. Send your order to the Construction Editor, Plant Engineering, Barrington, Illinois.


Westinghouse
dry type transformers
save Transitron Electronic
$5000 on installation costs

Growing rapidly since its founding in 1952, Transitron Electronic Corporation, now operating in three plants with a total footage of over 750,000 square feet, manufactures transistors, diodes, rectifiers, voltage regulators, controlled rectifiers and 4-layer switching devices. The modern distribution system serving Transitron's new plant—a renovated textile mill—includes 10 Westinghouse DT-3, 300-kva transformers. Plant Engineer H. R. Hammond (on cover) pinpoints how they saved Transitron over $5000 on installation costs.

"Weighing only 1800 pounds each—about 40% less than a conventional unit—the DT-3's were mounted 10 feet off the floor on simple channel irons between building support columns.

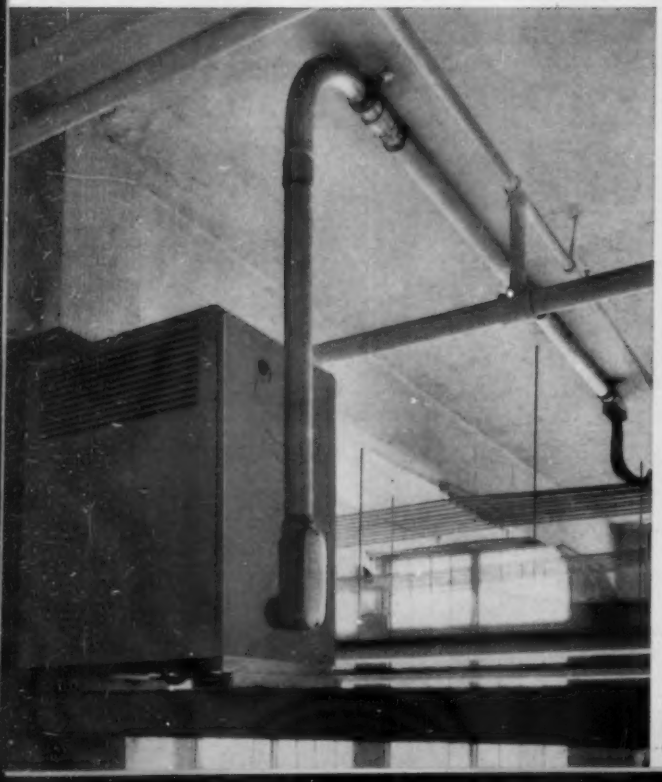
"At $20 a square foot, this saved us $1266 worth of floor space—not including an allowance for service area which would bring the saving to $4000. Since reinforced structural supports were not needed, we saved $40 on support material per unit.

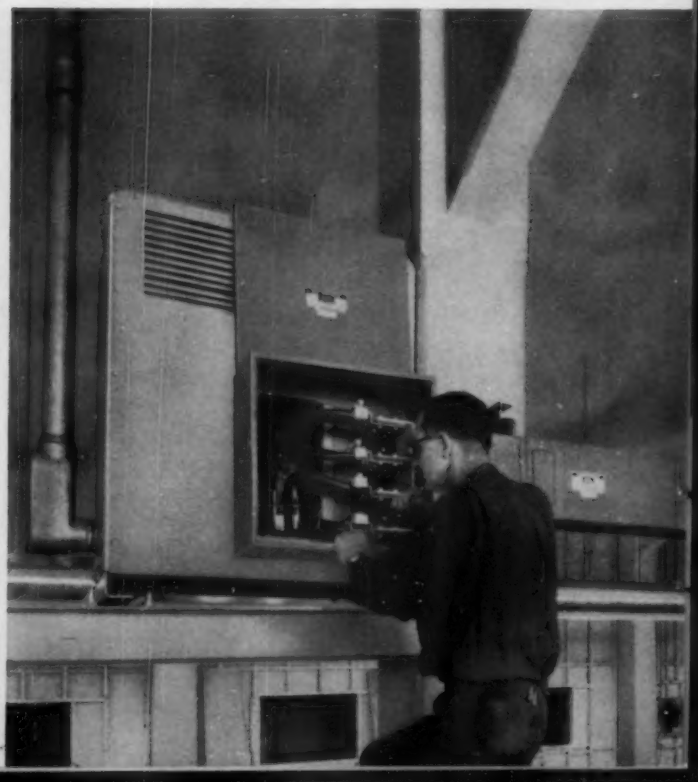
"That's not all. The Westinghouse transformers were quickly positioned with a fork lift truck. Hoisting heavier types would have required rental of extensive rigging equipment, plus 16 man-hours apiece at $68 per day.

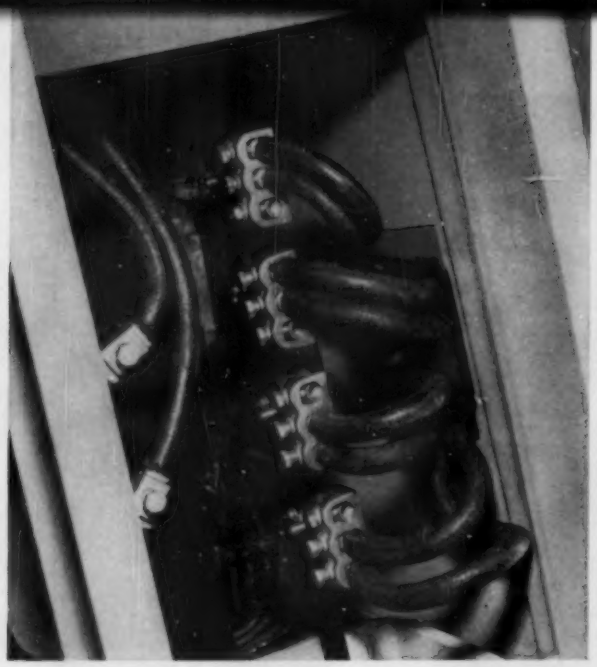
"Because of the transformer locations, 15 feet of 7-500,000 circular mill cable were eliminated. At $150 for cable, $50 for conduit and fittings, and $34 for labor, we realized a saving of $234 per transformer, or $2340.

"Our savings stem from the lightweight, compact size and special features of Westinghouse DT-3 Transformers"

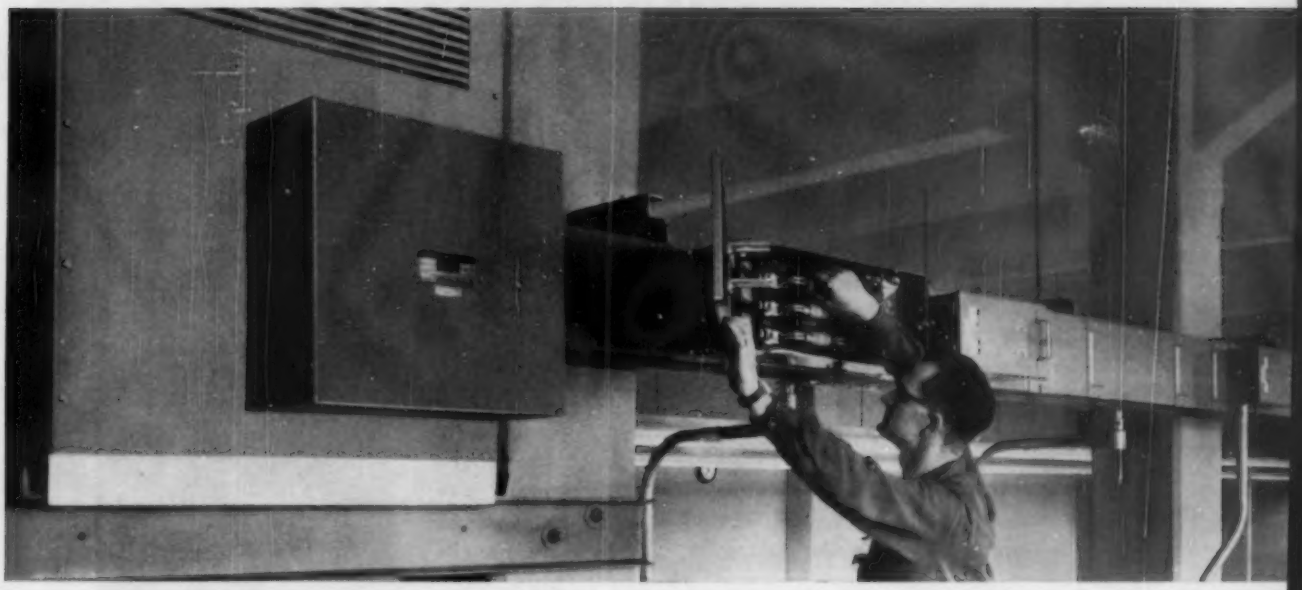
J-70951-2







"In addition, terminal compartments at the transformer bottom meant no extra insulation to withstand heat rise so we achieved a 60% saving. Since the transformers came with built-in shock mounts, we did not have to add them at an estimated total cost of $320.

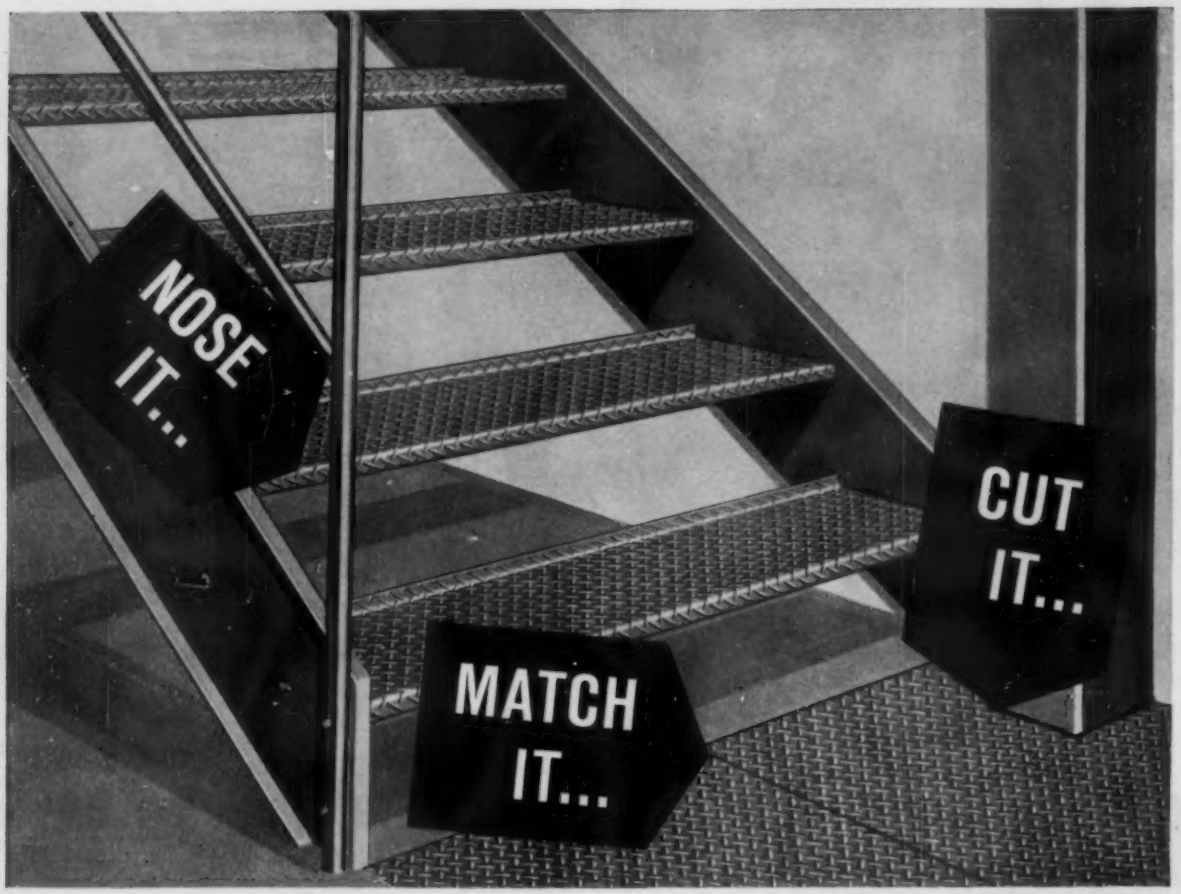


"Connected to the transformers is Westinghouse bus duct up to 70 feet long. Three lines leading through the duct deliver capacities of 1000 amps for production. The duct was easily tapped where necessary to put power where it's needed."

Only Westinghouse dry-type transformers guarantee you substantial installation savings. Check your nearby Westinghouse representative for details . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse. J-70951-3

Westinghouse

For more facts circle 564 on Reply Card



Alan Wood Super Diamond floor plate ...is easy to fabricate

Here's a heavy duty floor plate that can be sheared, formed, welded, and easily matched. The arrangement of the unique A. W. Super Diamond pattern allows you to bend it at any place.

A. W. Super Diamond will last for years... provides a safe, non-skid footing at all times. Easy to clean? A. W. Super Diamond can be swept, hosed or mopped easily . . . from any angle.

For easy fabrication and installation... for safety... for long wear ...specify A. W. Super Diamond. Write for Bulletin SD-S3.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver Canada: A. C. Leslie & Co., Ltd.

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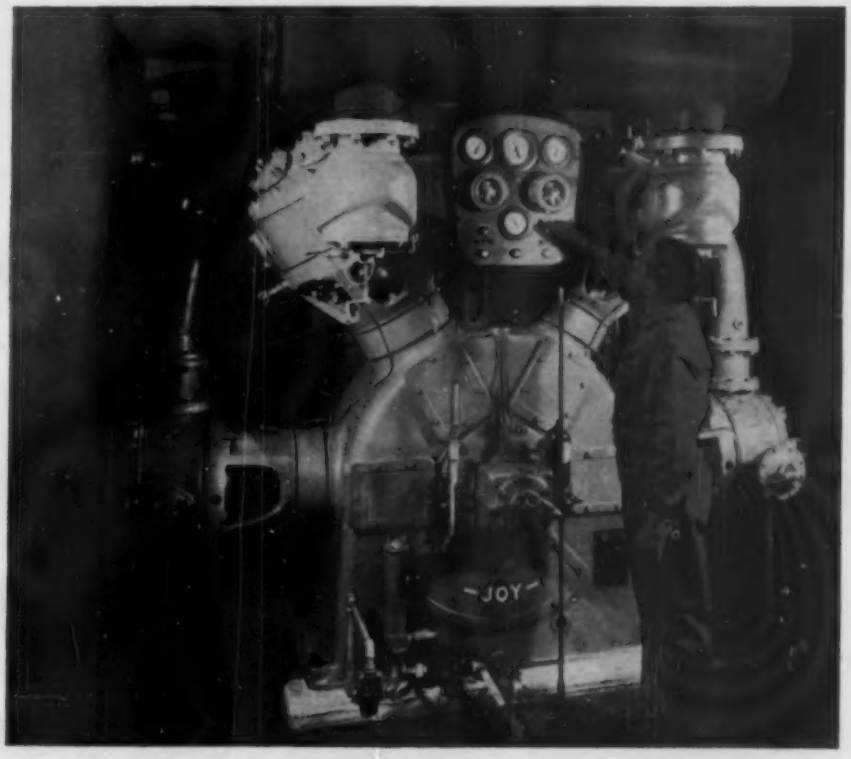
FOR CRITICAL INSTRUMENT AND PROCESS AIR REQUIREMENTS
JOY OIL-FREE COMPRESSORS



One of five Joy WNOL 114E oil-free compressors installed at a large mid-western brewery. Each 200 hp machine supplies 1100 cfm at 90 psi.

Joy oil-free compressors are usually found in the most critical applications. Delicate instruments used to control critical temperatures and pressures require air that is absolutely free of oil or moisture. Food, beverage and pharmaceutical processes demand clean, dry air. Joy compressors supply that air on a continuous duty basis and at low cost.

Heavy-duty construction with particular attention to the non-lubricated cylinder parts results in extremely low maintenance. Exclusive T-block piston rings compensate automatically for wear; inlet and exhaust valves are of highest quality stainless steel; cylinder liners are heavy chrome plated for corrosion resistance.

Such attention to construction details has made Joy the preferred compressors for critical non-lubricated service. Get complete information by writing for bulletin 2469-15.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

For more facts circle 566 on Reply Card

KILLARK...THE MOST COMPLETE of ALUMINUM FITTINGS and

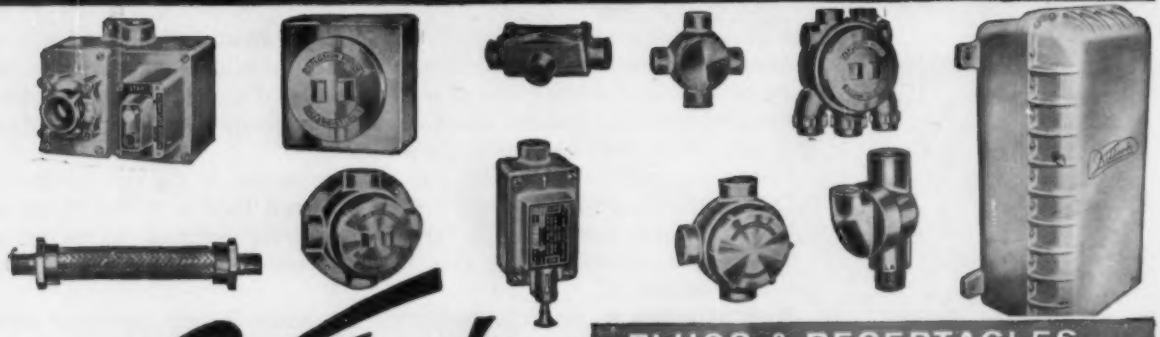
One source for all your fitting needs

FEATURING . . .

- Durable, lightweight all-aluminum construction
- Rustproof, corrosion-proof
- For standard and hazardous locations
- Fast, dependable deliveries from 19 strategic warehouse locations
- Backed by over 40 years' experience

STANDARD LOCATIONS

EXPLOSION-PROOF FITTINGS



PLUGS & RECEPTACLES

Killark

KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

VANDEVENTER AND EASTON AVE. • ST. LOUIS 13, MO.

and FASTEST-EXPANDING LINE FIXTURES IN AMERICA!

SWITCH RACK EQUIPMENT—EXPLOSION & WEATHERPROOF

PANEL BOARDS

CIRCUIT BREAKERS

MOTOR STARTERS

DISCONNECT SWITCHES

LIGHTING FIXTURES FOR HAZARDOUS LOCATIONS

Explosion-Proof

Vapor-Proof

Dust-Tight

LIGHTING FIXTURES—SPECIAL LOCATIONS

CATALOGS ON REQUEST

Send for Illustrated Literature

KILLARK ELECTRIC MFG. CO.
Vandeventer & Easton, St. Louis 13, Mo.
Gentlemen: Please send me following material:

- ☐ Explosion-Proof Fittings Catalog No. 13
- ☐ Condensed Catalog No. 59
- ☐ Vapor-Tight Light Fixtures Catalog No. 12
- ☐ Circuit Breakers Catalog No. 17

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Company_____

Address_____

City_____ Zone____ State_____

SOLD THROUGH LEADING DISTRIBUTORS' WAREHOUSE STOCKS IN NINETEEN CITIES

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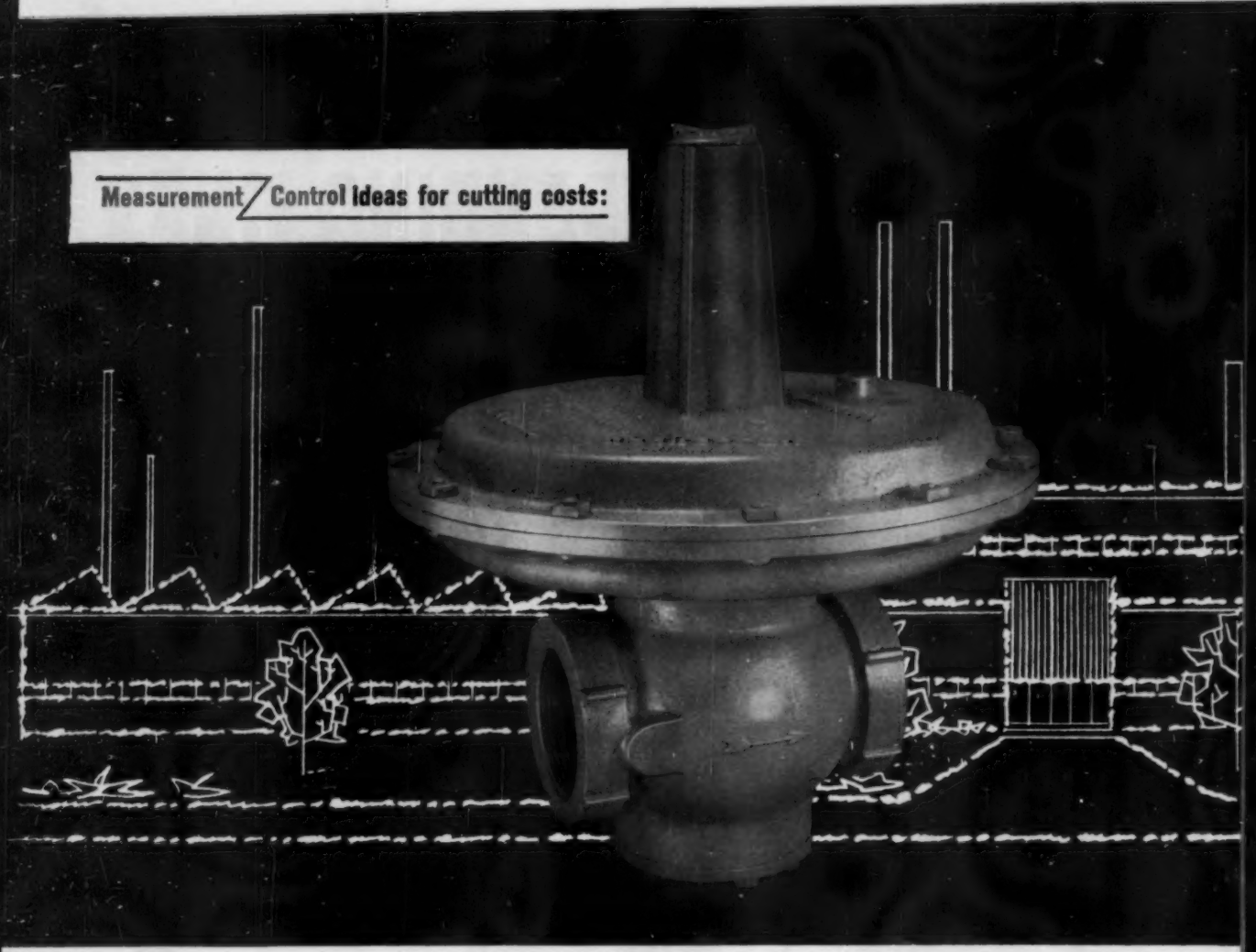

The $40.00 regulator that could have saved

$30,000.00

A gas pressure regulator like the one shown above was doing a precise job of regulating fuel gas in a glass plant—until a scaffold fell on it. Without the regulator, the entire plant was out of business. Down-time cost was about $30,000.00.

The Rockwell Field Engineer who personally rushed another regulator to this customer pointed out that an extra stand-by regulator would cost only $40.00—low-cost insurance against a possible $30,000.00 loss. The customer followed this recommendation, as well as others which the Field Engineer made in the interest of more efficient handling of measurement and control functions in this plant.

There are many ways a Rockwell Field Engineer can help *you* save time, money, and material wherever gases or liquids flow through pipe in your plant. He represents the largest and most experienced manufacturer of measurement and control products—and this experience can pay off for you. New or different uses of valves or regulators can prevent waste and inefficiency. Rockwell gas and liquid meters can measure almost anything that flows through a pipe, and can often assure big savings in time and labor, while improving quality.

It costs nothing to talk to a Rockwell Field Engineer—simply send the coupon.

ROCKWELL

The leading single source for Measurement / Control products and ideas

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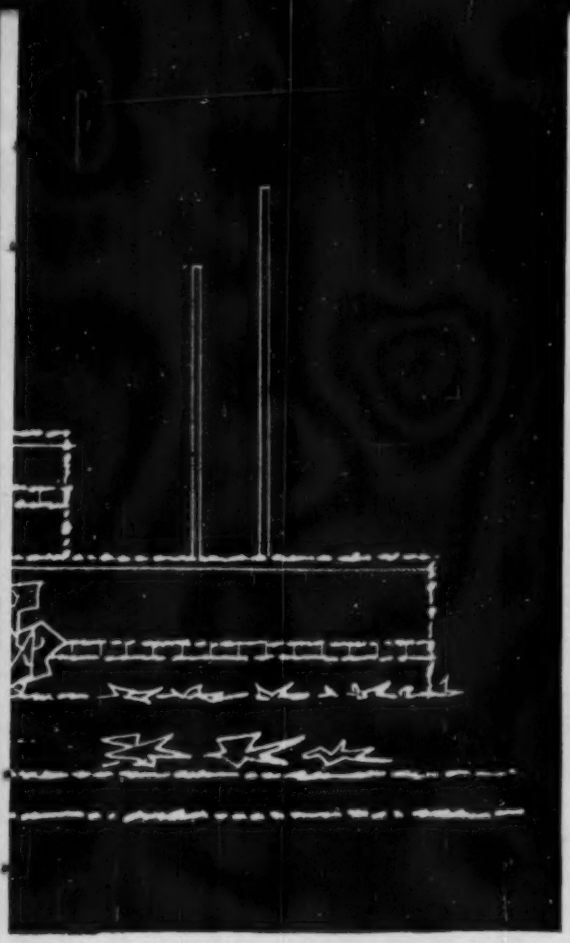


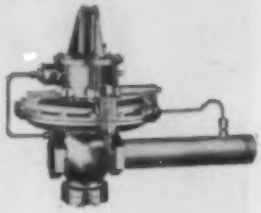
"IN-PLANT" METERING:

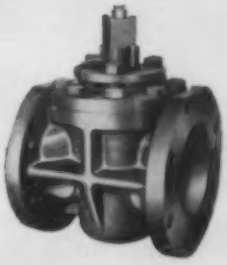
LIQUIDS AND GASES

"IN-PLANT" METERING can mean new cost cutting opportunities. Accurate liquid and gas meters are a positive way of improving cost control, insuring better use of materials, sharpening inventory control, and preventing waste. Whatever the need, Rockwell has the right liquid or gas meter to do the job better and at lower cost.

CONTROLLING PIPED MATERIAL:

LIQUIDS AND GASES





CONTROLLING PIPED MATERIAL more efficiently is a positive step towards cost cutting. Better valves can save wasted products and materials and often increase plant safety. Gas pressure regulators can cut costs by assuring safe, economical use of any gas used in the plant. Rockwell has the world's most complete line of flow control devices.

HOW MUCH COULD YOU SAVE?

There is hardly a plant of any kind—including yours—where the right application of the right measurement and control methods and equipment won't produce savings many times the modest cost involved. It will cost you nothing to have a Rockwell Field Engineer *show* you. Simply send the coupon below, now.

SEND COUPON NOW!

MEASUREMENT & CONTROL DEVICES

another fine product by

ROCKWELL

Rockwell Manufacturing Company, Pittsburgh 8, Pa. MC2M

☐ Please have a Rockwell Field Engineer call me for an appointment.

Please send literature on ☐ Controlling gas pressures; ☐ Valving gases, liquids and slurries; ☐ Measuring liquids; ☐ Measuring gases.

I am concerned primarily with ☐ Light & Heavy Metal Fabricating ☐ Basic Chemical Production ☐ Chemical Processing ☐ Food, Drugs & Tobacco ☐ General Manufacturing Operations ☐ Petroleum Processing

☐ Others: _____

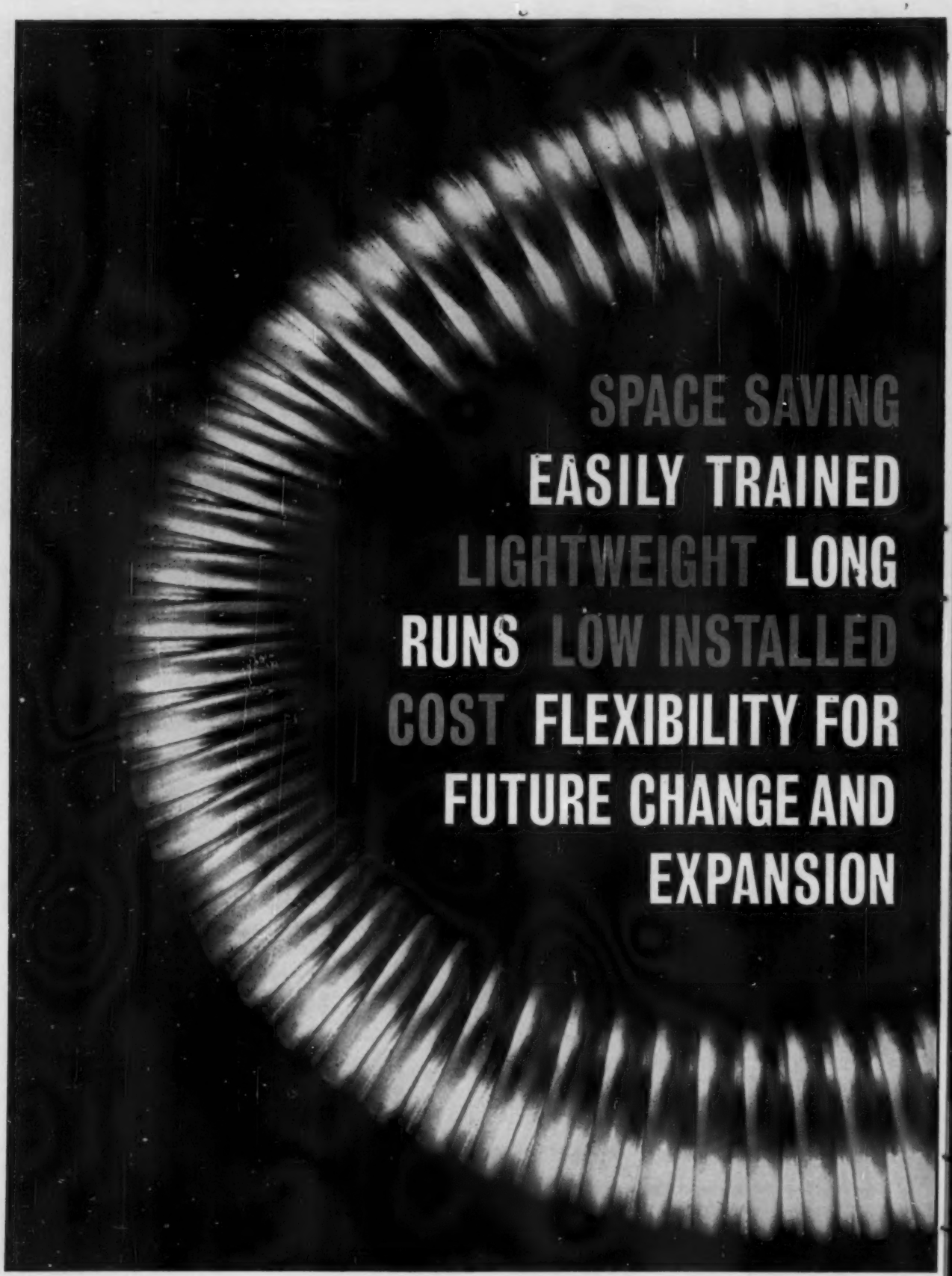
Name: _____ Title: _____

Company: _____

Address: _____

City: _____ Zone: _____ State: _____

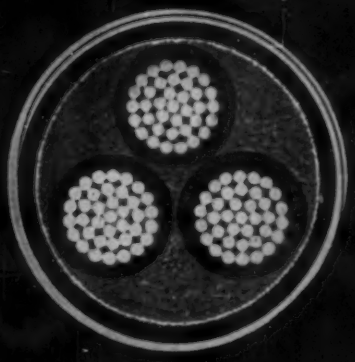
For more facts circle 568 on Reply Card



GENERAL CABLE

INTERLOCKED ARMORED CABLE

For full protection under all conditions install General Cable Interlocked Armor...the cable for power, control, communication and lighting systems. This compact, versatile cable is available in a wide range of constructions, insulations, armors and voltage ratings. Colored polyvinyl chloride jacket over the armor can be furnished where required. "How to Obtain the Greatest Advantage Per $ Spent" a comprehensive folder detailing General Cable's complete line of Interlocked Armored Cables is available upon request. **General Cable Corporation**, 730 Third Avenue, New York 17, New York. Offices and Distributing Centers Coast-to-Coast.



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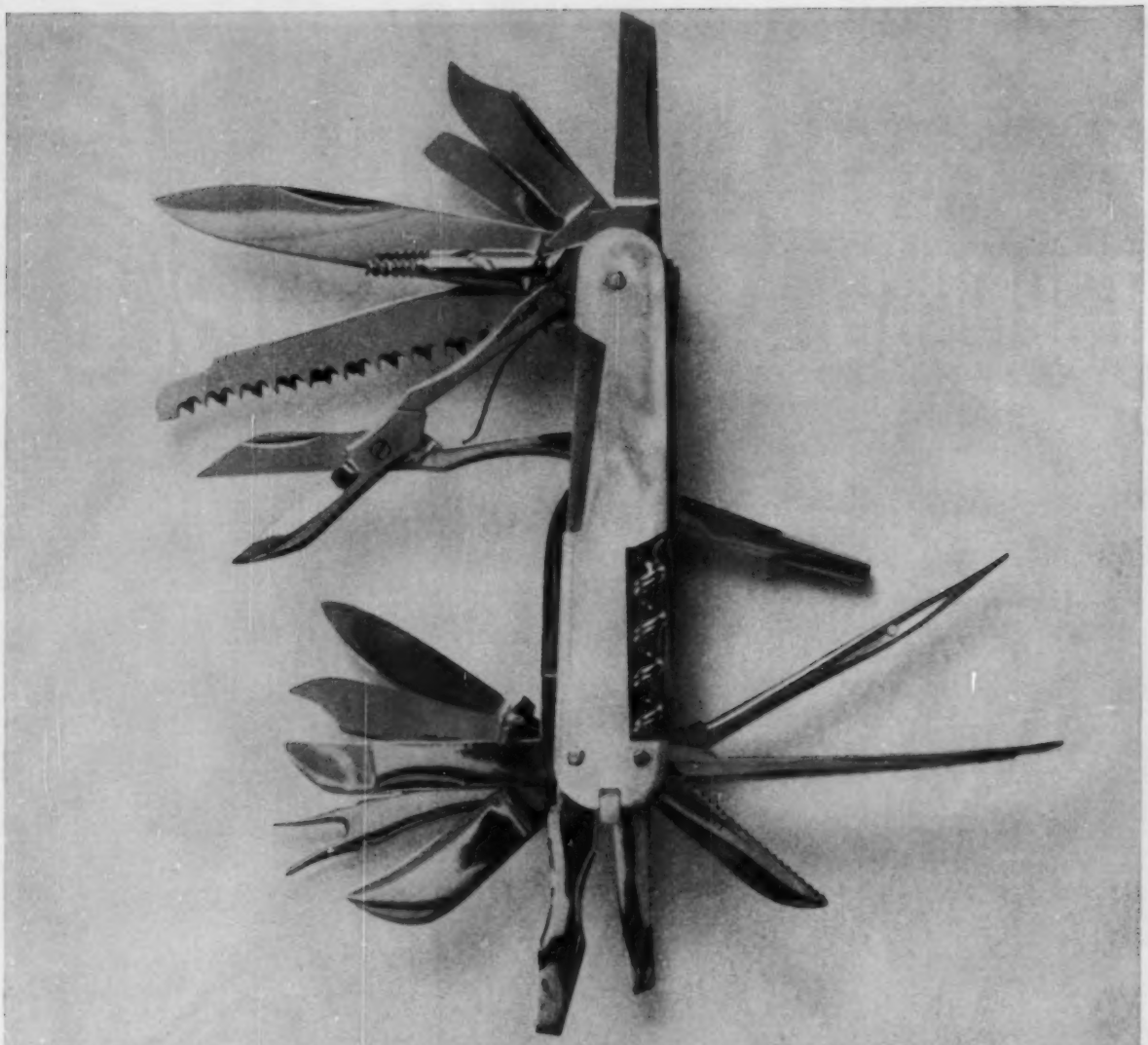


VERSATILE

Here you see an ingenious collection of tools. Yet this superb combination knife cannot compare with INLAND 4-WAY SAFETY PLATE in versatility of performance. In fact, when it comes to describing the range of uses for easy-to-fabricate INLAND 4-WAY, there seems to be no limit.

Users tell us they especially like 4-WAY's versatility made possible by its 3 different raised-lug patterns—small, medium and large; by its 15 different gages from 18 gage up to ¾" thickness; by its range of weights from 2.4 pounds to 31.65 pounds per square foot; and by its availability in widths from 24" all the way up to 72". *For shop use, fleet maintenance, as a basic material in the fabrication of products, as a structural building material, 4-WAY is ideally useful. Write today for your copy of Inland's 4-WAY Safety Plate Booklet.*

available from your steel service center

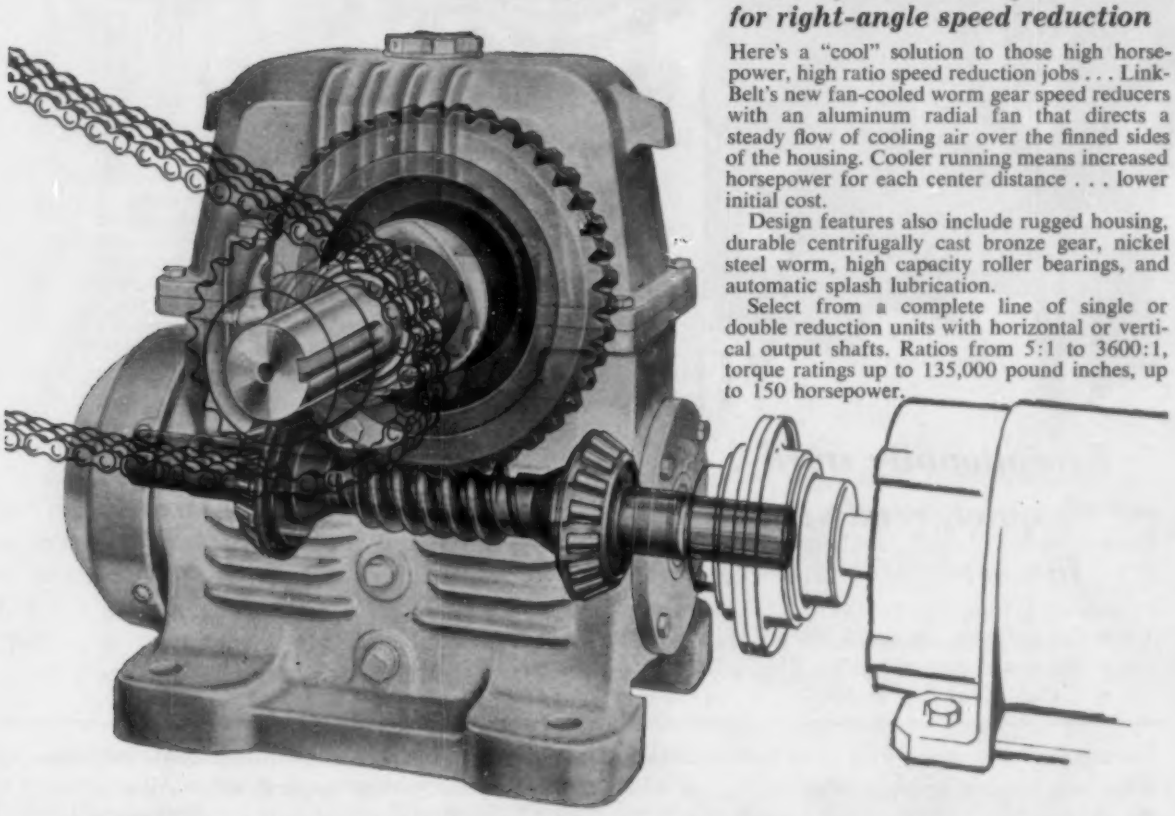
INLAND 4-WAY® SAFETY PLATE

INLAND STEEL COMPANY
30 W. Monroe St. • Chicago 3, Ill.

For more facts circle 570 on Reply Card

NEW LINK-BELT WORM GEAR SPEED REDUCERS

fan-cooled high capacity compact



Industry's most complete line for right-angle speed reduction

Here's a "cool" solution to those high horsepower, high ratio speed reduction jobs . . . Link-Belt's new fan-cooled worm gear speed reducers with an aluminum radial fan that directs a steady flow of cooling air over the finned sides of the housing. Cooler running means increased horsepower for each center distance . . . lower initial cost.

Design features also include rugged housing, durable centrifugally cast bronze gear, nickel steel worm, high capacity roller bearings, and automatic splash lubrication.

Select from a complete line of single or double reduction units with horizontal or vertical output shafts. Ratios from 5:1 to 3600:1, torque ratings up to 135,000 pound inches, up to 150 horsepower.

FOR FULL-LINE FACTS

on Link-Belt's comprehensive line of speed reducers—contact your nearest Link-Belt office or authorized stock-carrying distributor . . . or check and send this coupon to Link-Belt Company for data on all or any combination of the following:

- ☐ gearmotors—Catalog 2747
- ☐ motogears—Catalog 2747
- ☐ in-line helical gear speed reducers—Catalog 2751
- ☐ shaft-mounted speed reducers—Catalog 2618
- ☒ worm gear speed reducers—Catalog 2824
- ☐ universal worm gear speed reducers—Catalog 2724
- ☐ parallel shaft speed reducers—Catalog 2719
- ☐ fluid drives—Catalog 2747
- ☐ P.I.V. variable speed drives—Catalog 2274

LINK-BELT

15,340

PRUDENTIAL PLAZA, CHICAGO 1, ILL.

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FIRM_____

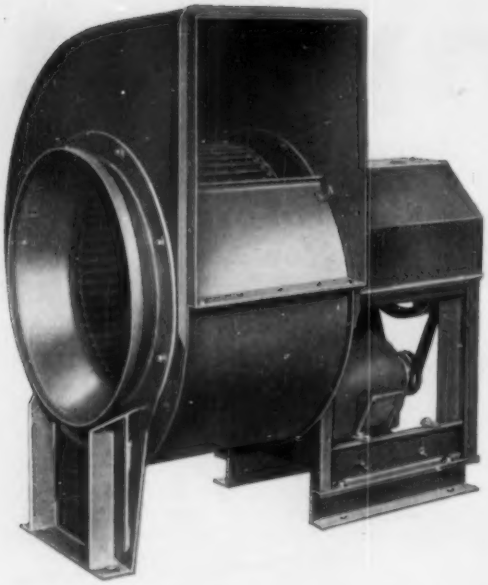
ADDRESS_____

CITY_____ ZONE___ STATE_____

For more facts circle 571 on Reply Card

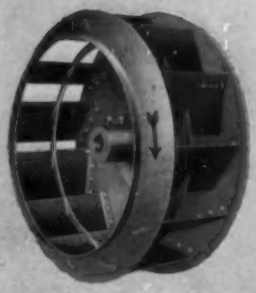
CLARAGE

New line of
V-belt driven
Ready Units



LS Ready Units have Low Speed, forward curved blade wheels. These are of the long-recognized Clarage Type HV multiblade design.

or



MS Ready Units have Medium Speed, backward inclined blade wheels with non-overloading horsepower characteristic. These are of the highly regarded Clarage Type NH, Class I design.

Exceptionally sturdy, quiet, ready-to-run fan sets

- for volumes up to 25,000 CFM
- for static pressures thru 2½"
- for clean air up to 300° F.

Distinguishing points — over 15 of them — make these new Clarage units outstanding.
To mention a few: Better motor ventilation . . . entire drive within frame of unit . . . complete accessibility to motor, drive, and bearings. Learn more about the numerous specific advantages that mean greater value to you from Clarage. Request Catalog 517 . . . 36 pages of complete information, selector charts, capacity tables, dimensions. Clarage Ready Units are ideally suited for supply or exhaust jobs — indoors or outdoors — for buildings of all types, all sizes.

Write for your Copy

Dependable equipment for making air your servant

CLARAGE FAN COMPANY

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

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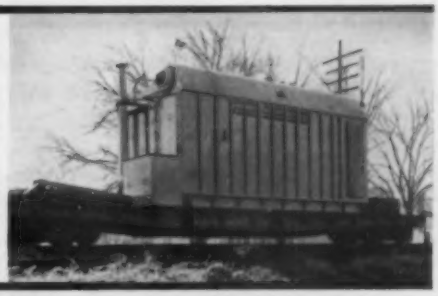
IN C-E PACKAGE BOILERS

UTILITY-BOILER ENGINEERING

GIVES EXTRA DEPENDABILITY

To a large extent, a utility company's operating cost is based on the efficiency and dependability of its steam generating equipment. With a major part of its business being with these power companies, C-E has developed a "utility-boiler" engineering philosophy that applies to *all* C-E products, large or small. You can be sure that *your* C-E boiler represents the latest thinking in thermodynamics and boiler design – and that materials and construction meet the most exacting standards. For *extra dependability*, specify "C-E."

Write to C-E for answers to your questions on C-E package and shop-assembled boilers. Catalogs are currently available on types VP, PCC and HCC.



(at right) 4,000-90,000 lb/hr—The compact Type VP package boiler is available in a wide range of capacities from 4,000 to 90,000 lb/hr. Shipped ready to install on a simple foundation. Features include: Pressurized firing, water cooling on all four sides, push-button operation, minimum noise and vibration.

C-E SHOP-ASSEMBLED BOILERS: TYPE VP – Package boiler for the majority of industrial steam needs; TYPE PCC – Controlled circulation. For high output, high temperatures; TYPE HCC – High-temperature-water boiler. For large-scale heating uses; TYPE WCC – Utilizes waste heat from industrial furnaces. Controlled circulation.

COMBUSTION C-E ENGINEERING

General Offices: Windsor, Conn. • New York Offices: 200 Madison Avenue, New York 16, N. Y.

Canada: Combustion Engineering-Superheater Ltd.

C-285A

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

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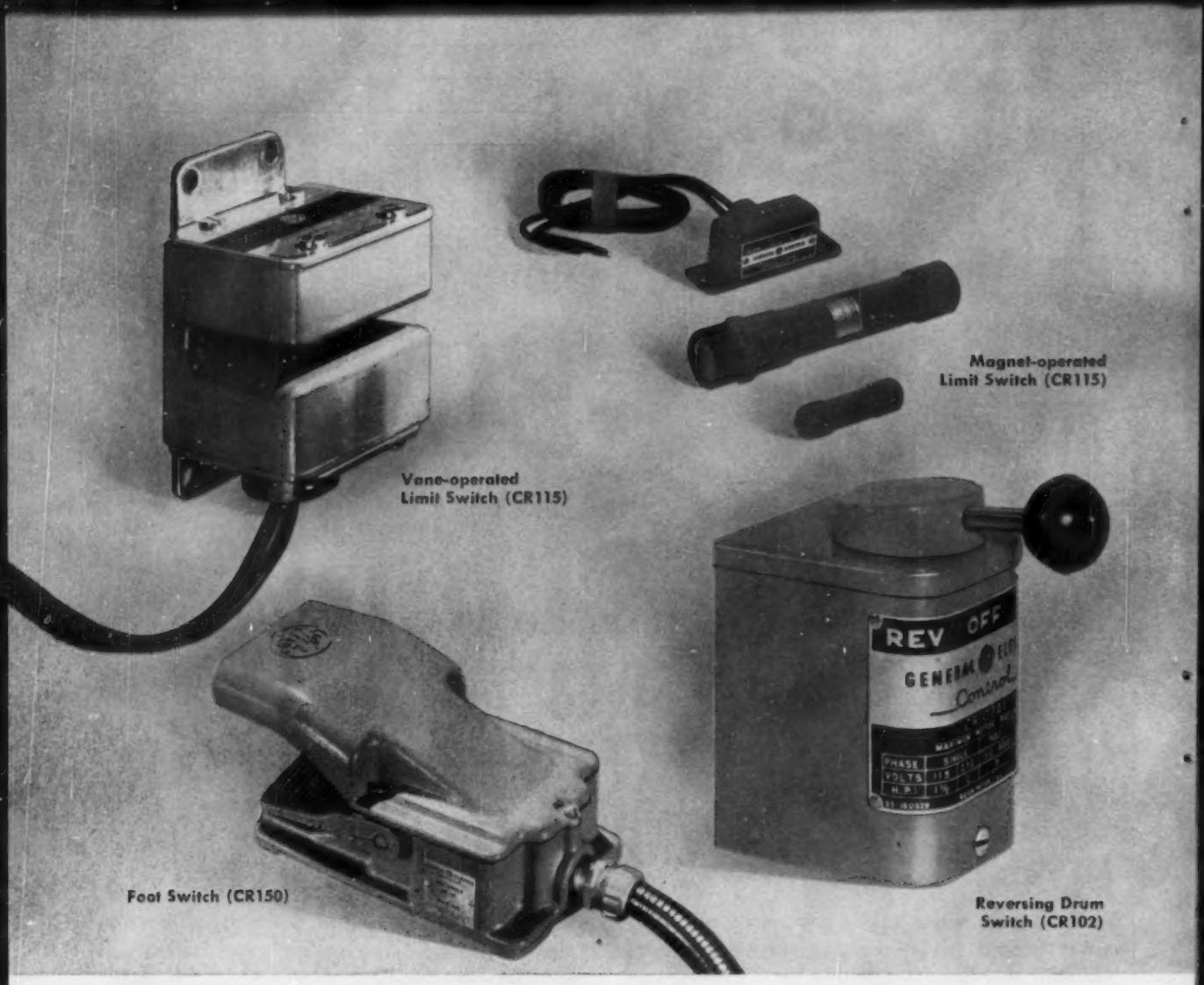


AVAILABLE NOW . . . More Measurable Advantages From General Electric Control:

In 1960 Alone . . . 9 NEW Devices

Progress at General Electric's Control Department means important benefits for you—distinct and valuable advantages that can be measured in terms of time and money in your own operation. We invite you to evaluate these benefits for yourself.

NEW VANE-OPERATED LIMIT SWITCH (CR115) gives from 30 to 50 million operations! Performs position-detection function of conventional switches *without physical contact* by passing a vane through a slot. The vane magnetically operates a contact. Switch is encapsulated to seal out contaminants. Bulletin GEA-6995.

NEW MAGNET-OPERATED LIMIT SWITCH (CR115 A19) *eliminates* physical contact with levers, arms, rods, or shafts. Performs position-detection function where precise control of moving object is not possible or where there is no opportunity to run a vane through a slot. Detects erratic motion on such applications as overhead conveyors. Oil-, dust-, and water-tight. Bulletin GEA-7305.

NEW FOOT SWITCH (CR150) offers rugged, cast-iron construction—will not skid during operation. Water-, oil-, and dust-tight switch is available in single- or two-stage forms with or without guard. Bulletin GEA-7086.

NEW REVERSING DRUM SWITCH (CR102) can be changed from maintained to momentary contact in seconds—without tools! Gives exceptional durability, positive "feel." *Easy* to wire and install. Bulletin GEA-7000.

NEW MINIATURE OIL-TIGHT PUSH BUTTONS (CR104) cut your panel space requirements *at least* 40 percent. Complete new line offers buttons, selector switches, illuminated buttons and indicating lights. Color coding available in both rings and buttons. Bulletin GEA-7127.

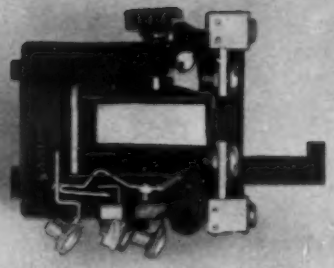
NEW WYE-DELTA REDUCED VOLTAGE STARTERS (CR132, CR7053) provide low inrush current resulting in low starting

You get MEASURABLE ADVANTAGES
WITH GENERAL ELECTRIC CONTROL

Miniature Oil-tight Push Buttons (CR104)

Wye-delta Reduced Voltage Starters (CR132, CR7053)

Stainless Steel Starter Enclosures (CR107, CR108, CR1062, CR7008)



NO-NC Overload Relay (CR124)

Pressure Switch (CR127)

Longer Life, Space Savings, Increased Flexibility, Better Protection

for Better Control in Your Plant

torque. Two types are available: Open transition, which is particularly suitable for long-time acceleration; and closed transition (auto transformer) which minimizes current or torque dips. Bulletin GEA-6860.

NEW STAINLESS STEEL STARTER ENCLOSURES (CR107, CR108, CR1062, CR7008) for use where corrosion is a problem—give neat appearance, match other equipment. Switch handles are chromium-plated; hardware and mounting feet, stainless steel. Enclosures provide watertight protection. A complete line of enclosures is available for manual and magnetic across-the-line starters.

NEW NO-NC OVERLOAD RELAY (CR124), a two-circuit relay for use with signalling devices such as indicating lights or alarm bells, assures positive visible or audible overload detection.

NEW PRESSURE SWITCH (CR127) features visible trip indicator and calibrated range scale in cover. Unique neon pilot light indicator is optional. Low- and high-pressure forms are available in both bellows or piston types. Bulletin GEA-7302.

For more information on the *measurable advantages* of these new General Electric control devices, contact your G-E Apparatus Sales Office or Authorized Distributor or write to Section 813-27, General Electric Co., Schenectady 5, N. Y. for the bulletins listed.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 574 on Reply Card

HERE'S THE POINT-BY-POINT STORY...

How General Electric designed ease of installation and maintenance, high reliability into magnetic starters

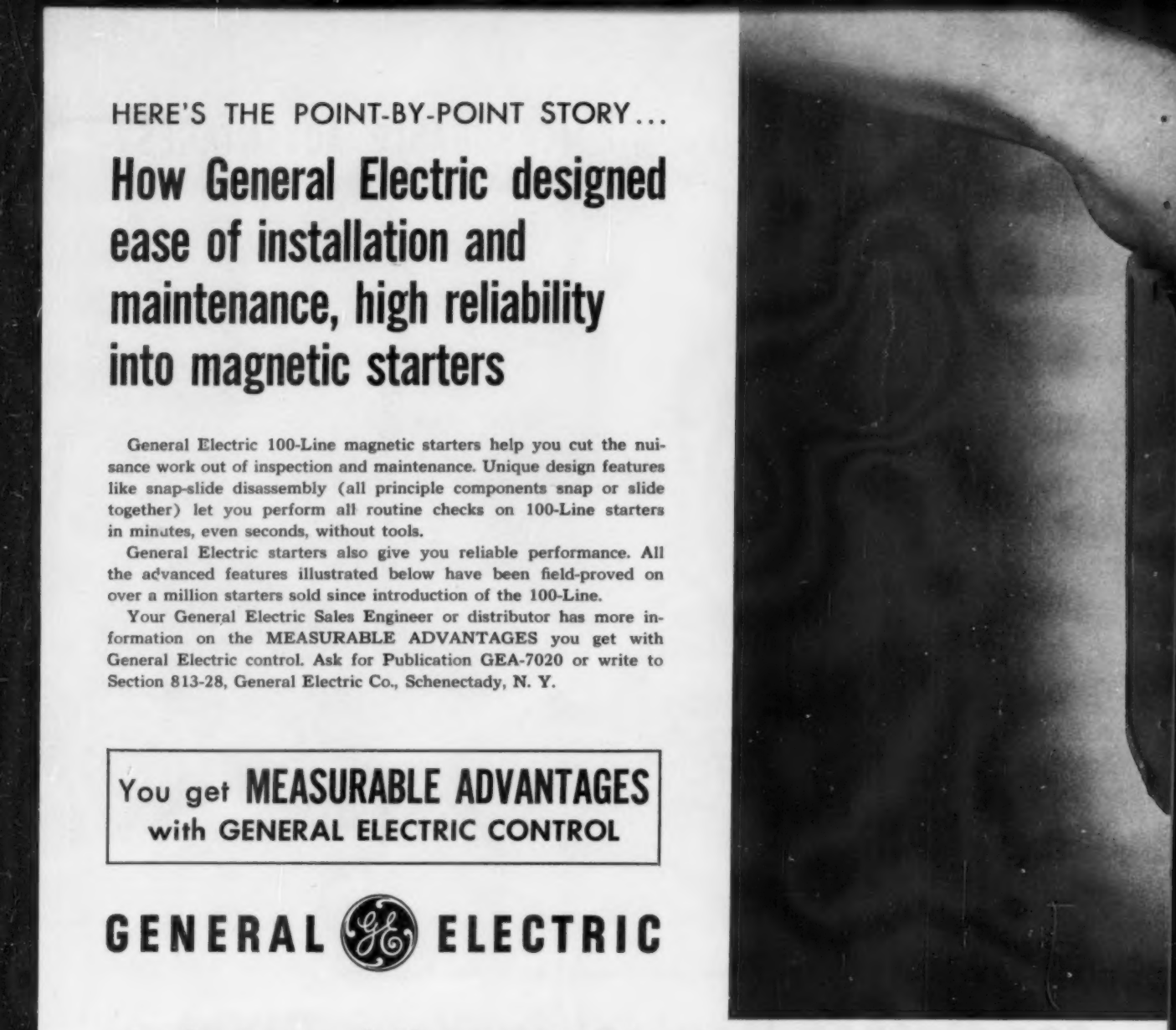
General Electric 100-Line magnetic starters help you cut the nuisance work out of inspection and maintenance. Unique design features like snap-slide disassembly (all principle components snap or slide together) let you perform all routine checks on 100-Line starters in minutes, even seconds, without tools.

General Electric starters also give you reliable performance. All the advanced features illustrated below have been field-proved on over a million starters sold since introduction of the 100-Line.

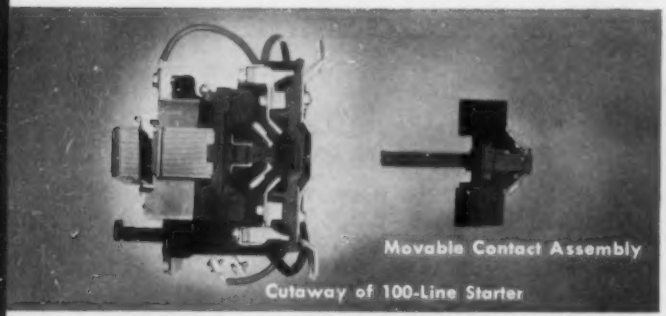
Your General Electric Sales Engineer or distributor has more information on the MEASURABLE ADVANTAGES you get with General Electric control. Ask for Publication GEA-7020 or write to Section 813-28, General Electric Co., Schenectady, N. Y.

You get **MEASURABLE ADVANTAGES**
with **GENERAL ELECTRIC CONTROL**

GENERAL ELECTRIC

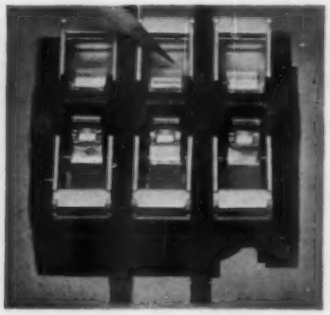


Only General Electric 100-Line Magnetic Starters offer



Cutaway of 100-Line Starter

LESS BOUNCE, LONGER LIFE RESULT FROM SLANTED CONTACT DESIGN, HORIZONTAL ACTION. Bounce on closing and dust accumulation are two major causes of contact deterioration. General Electric's slanted contacts and horizontal action virtually eliminate both problems. The unique angled mating of contact surfaces provides positive "make" and "break," with less bounce, less resultant arcing. The slanted surfaces shrug off dust and other contaminants that could cause contact pitting.

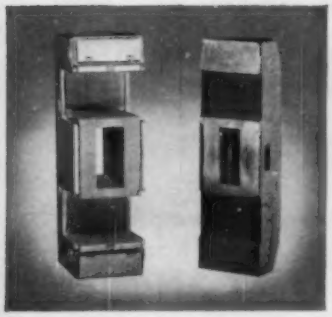


MAGNETIC STEEL ARC TRAP EXHAUSTS CONDUCTIVE GASES, REDUCES CONTACT EROSION. Size 2 starters feature arc trap which exhausts ionized gases, contains and quenches arcs. Arc trap attracts, splits and cools arcs quickly, reducing contact erosion, extending contact life.

STRONGBOX MOLDED COIL PROVIDES POSITIVE PROTECTION FOR COIL WINDINGS. Glass-filled alkyd resin protects coil by preventing the flexing of coil windings; also resists dirt, oil, water, and mechanical damage.

10-SECOND CONTACT INSPECTION AND 25-SECOND COIL CHANGE is possible with G.E.'s unique snap-slide construction. Just lift off coil retainers (left) and lift out contact assembly (right) to inspect both fixed and movable contacts. To change coil, lift off retainers, remove clip and "I" magnet.

you all these features for greater reliability, flexibility



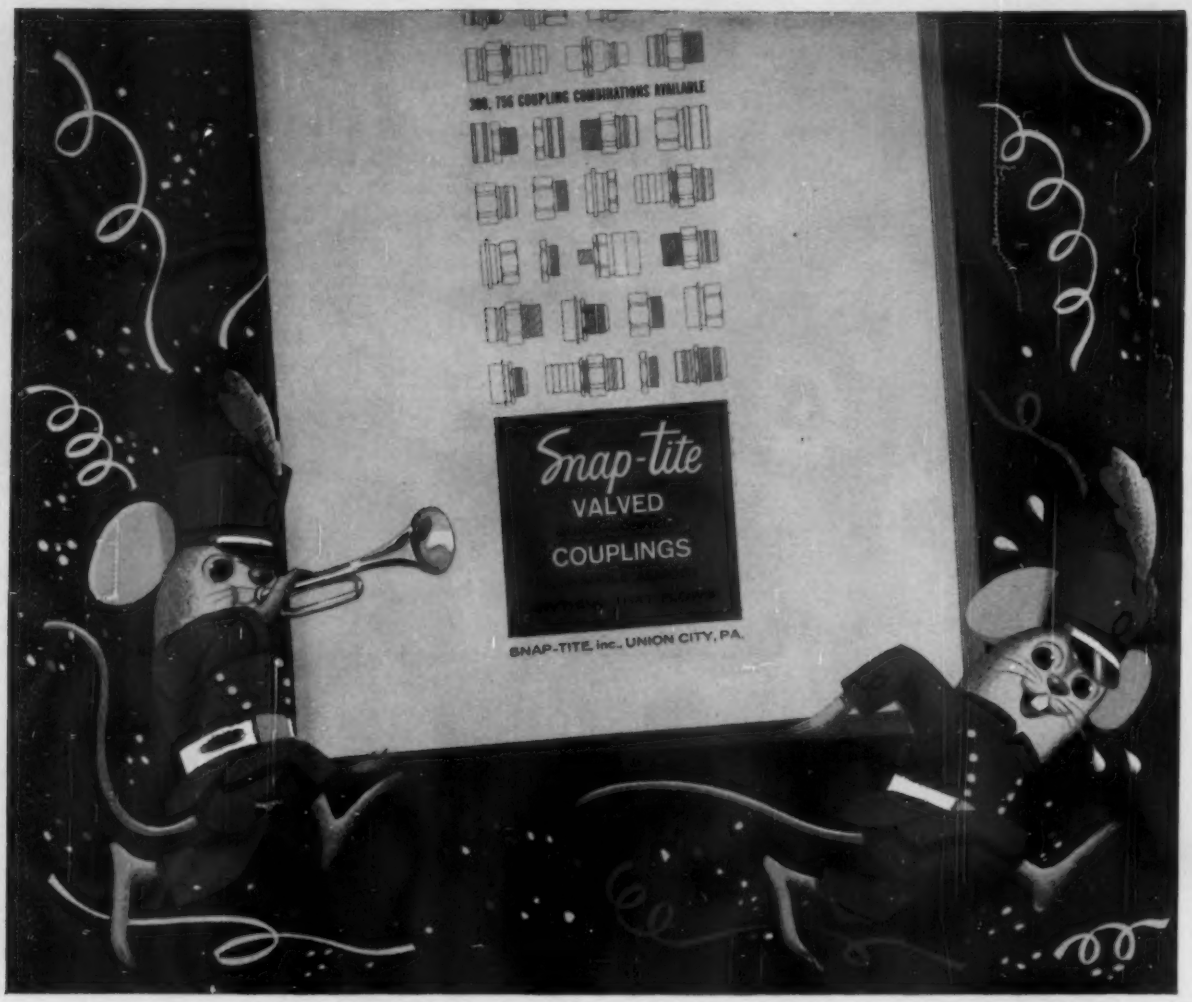
POSITIVE "MAKE", CLEAN DROP-OUT IS PROVIDED BY G-E MAGNET DESIGN. Any voltage sufficient to move magnet seats it firmly. Air-gap, short flux path reduce residual magnetism, provide clean drop-out.

BIMETALLIC OVERLOAD RELAYS ARE TRIP-FREE, ADJUSTABLE ±15%. Bi-metallic relays, standard on all 100-Line starters, cannot be held closed during overload. Handy knob allows ±15% adjustment of trip setting. Overloads can be reset manually or automatically.

INDUSTRY'S MOST COMPLETE LINE OF MODIFICATION KITS GIVES FLEXIBILITY. Indicating light, selector switch, push button for cover; plus auxiliary contact, third overload relay, fuse clips, and coils can all be installed in General Electric 100-Line magnetic starters in the field.

STURDY WRAP-AROUND ENCLOSURE HAS KEYHOLE SLOT MOUNTING for simple, secure installation. Just slip the keyhole slots over screws. Screws support the starter enclosure while tightening.

For more facts circle 575 on Reply Card



announcing—a dynamic new catalog for coupling users

complete specs on 308,756 possible coupling combinations

And it's hot off the press! This comprehensive new 62 page catalog contains complete information on all sizes and types of Snap-Tite quick-connect, quick-disconnect couplings for:

positive pressure applications; impact air tools; high pressure, vacuum and very low pressure; hard-to-handle fluids; no-spray applications; no-spill aircraft and missile applications.

Included are descriptive cutaway and exploded illustrations and complete weight and dimensional data for all sizes, ¼" to 6". Working pressures, flow, pressure drop and spillage data are also provided in detailed graphs and charts.

SPECIAL! RUBBER GASKET USAGE GUIDE SECTION
For the first time in the quick-connect coupling field, a compilation of complete selection data describing packer seals to use in handling over 300 fluids and gases.

Write today on your company letterhead for free copy!

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WHAT'S JUST AHEAD IN THIS ISSUE

● SPECIAL SECTION

"Industrial Construction and The Plant Engineer"

Fifteen articles, comprising a 48-page section of this issue, detail many facets of the plant engineer's role and responsibility in new plant construction. If you're planning to build, these articles offer a wealth of information for you:

Industrial Construction . . . A Definition

Plant Engineer's Role in Site Selection

Plant Engineers, Architect Team Up On Layout

Planning, Design, Construction of an Industrial Plant

Project Control—Controlling Money, Time and Manpower

Heating, Cooling and Humidifying Plant Air

Design and Construction of a "Clean Room"

Plywood in Plant Construction

Industrial Power Distribution Designed for Continuous Service

Industrial Plant Concrete Floors

A New Prefab—Of Paper Honeycomb

Fire Protection With Piped Dry Chemicals

Lighting Design for Plant Offices

Pre-Engineered Metal Buildings

The Plant Engineer in Construction . . . An Evaluation

● MOVING BOTH the workpiece and the tool is the most complex operation in a pneumatic-hydraulic system. The article on page 157 presents a detailed description of the circuitry for two different operations to give you an idea of the many factors that have to be considered in designing such a system. This article completes the 12-part series that has been presented on the design of pneumatic-hydraulic circuits.

● INDUSTRIAL LIGHTING was the subject of an all-day conference co-sponsored by PLANT ENGINEERING and the Chicago Lighting Institute. More than 100 plant engineers attended to learn about new equipment and techniques for plant and office lighting installations. Highlights of the conference will be found in the editors' report starting on page 166.

● MACHINES WHICH duplicate human behavior—in the logical approach to a decision—are being used to control industrial processes. Their use is based on control of variable inputs to produce a predictable output from an automatically-controlled operation. For an insight on potential applications for such equipment, see the article "Controls That Make Decisions" on page 170.

THIS MONTH PLANT ENGINEERING chalks up another "first" in its continuing program of serving the interests of its readers. The special section, "Industrial Construction and the Plant Engineer" which begins on the facing page, presents a series of articles with various titles but with one common theme — the important role of industry's plant engineers in the construction of new plants.

Our authors, using their own experience as their authority, have written about site selection, plant layout, construction of a plant, how to keep tabs on the construction project .... all important phases of industrial building. Important to the plant engineer, because as his company's representative on the jobsite, his is the responsibility to get (and give, when he is also constructing the plant) full measure for each dollar budgeted to the project.

Not a text, full of figures and formulas for the ONLY way to build a plant, but rather a valuable guide to the basics of industrial construction on which to build the programs, schedules, designs and controls that are applicable to each individual project. And, for extra value to you, we've included articles on some new materials and techniques.

The men on the cover . . .

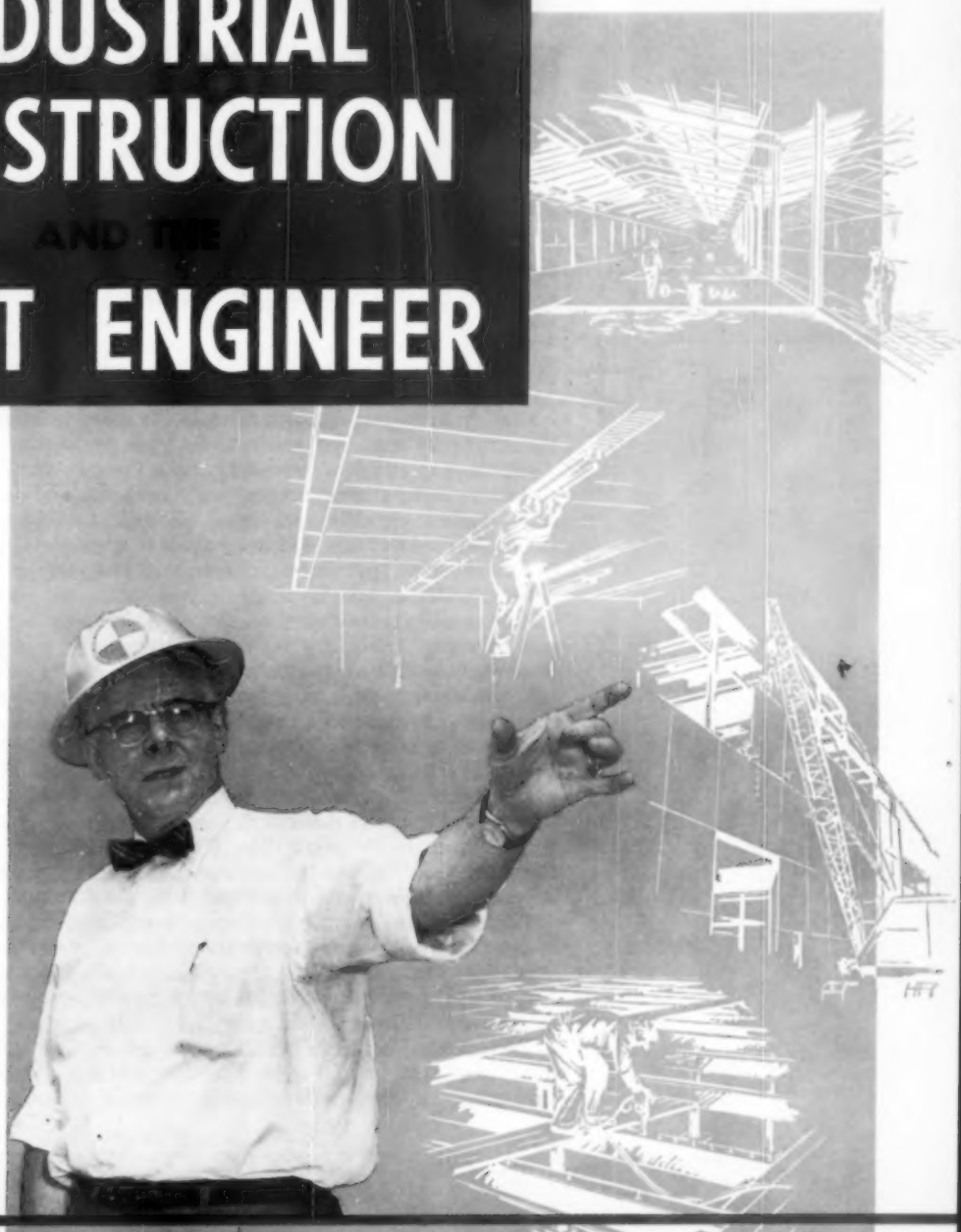
On the right, Kim T. Speer, Superintendent of Maintenance and Construction for R. J. Reynolds Tobacco Company, in Winston-Salem, N. C. On the left, Andy Anderson, PLANT ENGINEERING's Construction Editor. The photograph was taken during Andy's inspection tour of the construction site of Reynolds' new $30,000,000 cigarette production facility. Part of the story of that new plant, written by Mr. Speer, appears in the special section.

You'll see a lot of these two men, as you read the section. We intended it that way, to illustrate graphically the close association of PLANT ENGINEERING editors with the men—and the field—they serve. Construction is only a part of that field, but its importance to the plant engineer merits the editorial effort given the following 48 pages.

Let the "hard hats" remind you that where you, as a plant engineer, are involved in construction, PLANT ENGINEERING is interested . . . in your problems, your new ideas, the techniques you try and the cost-saving methods you inaugurate. We'd like to see your new plant, and publish your story, as we've published those on the following pages. Keep us posted.

We feel that the following "special section" in this issue of PLANT ENGINEERING will prove a worthwhile addition to your files. There are reprints available, of course; just send your request, we'll gladly fill it as long as the supply lasts.

INDUSTRIAL CONSTRUCTION AND THE PLANT ENGINEER



Kim T. Speer, right, at R. J. Reynolds Tobacco Co.'s new Winston - Salem plant with Andy Anderson, Construction Editor, Plant Engineering.

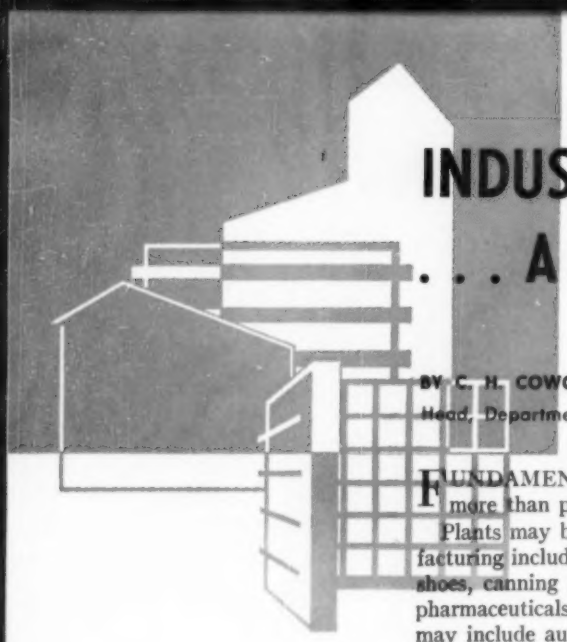
Almost inseparable—the plant engineer and industrial construction.

The first, a man or a functioning department; the second, a responsibility of that man or department.

Economically, industrial construction is the biggest "slice" of the construction market today; functionally, the construction of new facilities is a major portion of the plant engineer's responsibility.

In every phase of plant construction, from planning to production startup, the plant engineer is on the scene. Ubiquitous, we might say . . . . but he would shorten it to "busy" or "involved" if he were to describe himself during a construction project.

The plant engineer is *there;* he is the common denominator, the constant, no matter what the equation for construction responsibility—architect plus contractor plus plant engineer, contractor plus plant engineer, or plant engineer alone.



INDUSTRIAL CONSTRUCTION . . . A DEFINITION

BY C. H. COWGILL, FAIA,
Head, Department of Office Practice, American Institute of Architects

FUNDAMENTALLY, the designing and construction of an industrial plant is much more than providing the most economical enclosure for a manufacturing process.

Plants may be classified according to the characteristics of products. Light manufacturing includes textiles, paper, books, glass products, pottery, metalware, garments, shoes, canning and food processing, bakery goods, furniture, boxes and containers, pharmaceuticals, electronic equipment, hardware and tools. Heavy manufacturing may include automobiles, aluminum, airplanes, building equipment and components, railway engines and cars, and many kinds of machinery. Noxious manufacturing may include chemicals, petroleum products, steel and metal reduction plants.

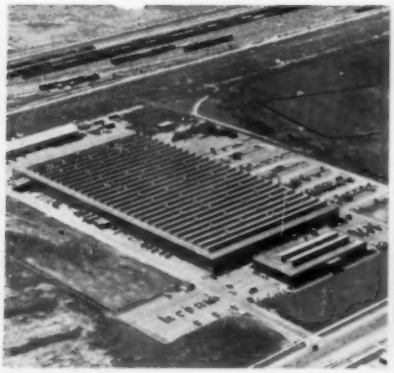
Plant buildings may be single-story or multistory. While light manufacturing is usually possible in multistory buildings, low buildings are often preferred. For heavy manufacturing (especially where foundations are required for heavy machinery) single-story buildings are usually preferred.

When a new plant is proposed one of the first questions is where to locate it. It should be convenient to a source of supply of materials used. In some cases these are raw materials and in other cases finished or partly finished goods.

Sources of materials are generally stable, but the labor market is constantly changing. In some plants the need for labor is being reduced by automation, but more worker intelligence is demanded. The quality of labor available should be studied therefore, as well as the quantity. When a new plant is proposed the climate, educational facilities, facilities for recreation and health, and other advantages which would appeal to the company's employees, should be investigated.

Even before the final design of an industrial building has been determined, its form of construction may be given attention. It may be assumed that it will have a frame of steel or concrete, but the choice of materials and form will depend upon: span lengths and applied loads; degree of fire resistance; number of stories; and need for skylights.

Exceedingly long spans are often desired for maximum flexibility in the use of space. For each form of construction there is a minimum, optimum, and maximum practical span. The use of spans longer than the optimum for ordinary loads increases



the cost. Longer spans are more feasible for roofs than for floors, especially if trusses or space frames may be used. The loads to be carried include the weight of the structural frame itself, and this is invariably greater for fire resisting construction. One-story construction not only permits longer spans, but also the daylighting of large areas by means of skylights, monitors or saw-toothed roofs.

The economy of daylighting may be questioned where winter temperatures are low, where summer cooling is adopted, and where electric rates are low. For multistory buildings, it is generally most economical to provide long spans only in those stories where they are needed, (even though concentrated column loads must be carried on girders) rather than to use long spans for every floor.

For many plants, the exterior walls are mostly glass, but the wisdom of this may be questioned under conditions indicated above for skylights. With the present high cost of masonry labor, the use of precast concrete and prefabricated metal components deserves consideration, especially where factory cranes may be employed to handle large wall units.

Among the more recently developed elements of construction are: tilt-up reinforced concrete walls which are usually cast in a horizontal position on the ground: prestressed and precast reinforced concrete beams and slabs: sandwich wall panels with metal or plastic surfaces and insulating cores: semi-cylindrical, segmental or warped reinforced concrete shells for roof construction.

The heating, air conditioning and illumination of factories are involved in the architectural and structural design, as has been suggested.

First, consider the use of glass, and compare the capital cost of masonry, sandwich panels, and glass for use in walls. This study might be broadened to include several types of masonry walls and panels, and single and double glazing with clear, patterned and colored glass; also several types of sun shades. From this data, a tentative decision may be reached, whether to: eliminate all windows; use only sufficient glass to afford contact with the exterior; use liberal glass areas for psychological effect; use daylight as either a complete or partial substitute for electric lighting.

For some manufacturing processes, ventilation is needed to remove contamination at its source. This may be combined with air conditioning, but an independent exhaust system (possibly including recovery of some products) may be indicated.

Electrical illumination includes the selection and location of fixtures and the wiring

work. Fluorescent lighting is standard for production areas and offices, and mercury vapor fixtures and incandescent lights are used outdoors. Foot-candle levels in production areas vary greatly and in offices the range is from 40 to 100. For efficient seeing, not only should foot-candles be adequate but also extreme brightness contrasts should be avoided. Light sources should not be in the line of vision and areas surrounding light sources should be illuminated —white ceilings should receive some light. For efficient use of light, the number of reflections should be as small as possible and reflecting surfaces should be white.

For no other type of building is site planning more essential. Generally some use, either present or future, or both, should be assigned to every part of the site. First consider the approach to the building or group of buildings. Who will see the plant from this point of view? Will it inspire enthusiasm and improve morale in employees? Will visitors be favorably impressed? Will it serve as effective advertising as viewed by passers-by? It need not be a large area, but if skillfully planned, a forecourt may be a relatively inexpensive means of giving distinction to the over-all design.

Unenclosed work areas must be planned in relation to the building plan. This goes also for interior courts, and possibly for recreation areas and provision for expansion. Parking areas should be as close to building entrances as possible and directly accessible to the highway. This should be concealed as much as possible. It is preferable to separate access roads to trucking areas from those to parking areas.

When a plant occupies a large site, engineering problems may present themselves both in the early stages of design and later. First, consideration must be given to the topography of land adjacent to the site, and access from highway, railway or other means of transportation—also the availability and adequacy of water, gas, steam and sewer lines. If a sprinkler system will be required, the placing of an elevated tank should be considered at the outset; and if power is to be generated, the placing and design of the power plant must have early consideration. In determining final grades, original grades should be disturbed as little as possible. Grades should be steep enough for drainage.

Finally, the needs for future expansion should be considered. Unless the buildings are designed to provide for the optimum capacity, with expansion provided by the future erection of one or more complete plants, the expansion of each department must be considered.

PLANT ENGINEER'S ROLE IN SITE SELECTION

By **W. E. IAN DAVIES**, Chief Engineer, Container Division, International Paper Company, Whippany, N.J.

INGREDIENTS of plant site selection cannot, unfortunately, be reduced to an engineering problem. At International Paper, however, we have tried to do the next best thing. Based on logic, and experience gained through the selection of more than two dozen sites—and the construction of a like number of plants, virtually all of which contain more than 50,000 sq ft—during the past ten years, we have developed a blueprint designed to keep us on the right track.

The I-P yardstick—if you can call it that—starts with a basic management decision: Do we need a new plant, and if so, why?

For these answers, the Market Research department goes to work. It thoroughly surveys the market potential and the strength of competition in the proposed new area. Its job: to determine if the proposed investment is justified or if present facilities can more profitably meet present and future needs, either with added efficiency

PLANT ENGINEER'S ROLE IN SITE SELECTION

or plant expansion and new equipment.

If and when market research gives the green light for a new plant, the manufacturing department comes up with budget estimates for machinery and equipment to meet the projected productive capacity.

At this point it is particularly important for the Engineering Department to determine the ideal type of site based on a plant layout which will produce the best operation from an efficiency and service standpoint. The alternative may be (and often is) Engineering finds itself having to accept a site selected by others, and then design a building to fit the site.

This latter course can produce some startling and sometimes inefficient and costly plant layouts and machinery flows. With an ideal site and building layout in mind, certain compromises can still be made with available sites without seriously affecting the basic economies of the proposed operation.

The Engineering Department then takes the site and plant layout closest to the ideal specifications and determines the anticipated cost of the project—based on equipment, probable building costs and land prices in the area under consideration.

Estimating Building Costs

One of the most difficult problems is to determine the estimated cost of the building. We have approached this by keeping very close records on past construction jobs and relating them to the specific area involved and to the rise in prices since the previous construction, based on the various building cost indexes which are available.

If you don't have a starting reference point for previous building costs, you can use budget estimates of several local contractors capable of handling the job. It is important in this regard to determine exactly what these estimates contain, since every business has peculiarities which will require additional expense above and beyond a basic building structure. Such unusual requirements may include extraordinary parking needs, unusual lobby displays, special power requirements, air conditioning of the manufacturing area, or a special office for visiting executives, along with other factors.

Next step: the whole ball of wax goes "upstairs" to top management—if it already has been approved by the divisional general manager involved and his staff superior.

At I-P, the Board of Directors has the final say on new plant construction. Once its approval has been granted, the Land Acquisition Department enters the picture.

A briefing session explains to them why the Sales and Market Research

CHECK LIST

1. MARKET SURVEY TO SELECT GENERAL AREA

2. SALES SURVEY TO SELECT COMMUNITIES

- A. Sales tonnage available estimated in each town.
- B. Sales tonnage available estimated within 50 miles and within 150 miles.
- C. Competitors in area.

3. COMPARISON OF SELECTED COMMUNITIES

- A. General
  1. Terrain
  2. Relative construction cost per sq ft
  3. Flood hazards
- B. Transportation Costs—Inbound and Outbound
- C. Population statistics
  1. Growth
  2. Corporate limits
  3. Labor drawing area
  4. Brief historical sketch
- D. Town Administration
  1. Political Party
  2. Form of Government
  3. Police
  4. Fire
  5. Garbage Disposal
  6. State Taxes
  7. Township Taxes
  8. Municipal Taxes
  9. County Taxes
  10. Park Board Taxes
  11. School Taxes
  12. Other Taxes
  13. Contemplated expansion of city facilities affecting tax rate
  14. Is the attitude of present city government favorable to industry?
  15. Indebtedness
  16. Housing; schools available
- E. Climate
  Average annual snowfall
  Average relative humidity
- F. Cost of Living
  Rent
  Food
  Clothing
  Transportation
- G. Labor
  1. Total labor pool available
  2. Characteristics of labor
     1. Agricultural
     2. Industrial
     3. Mining
     4. Special skilled groups
     5. Seasonal variations
  3. Strikes or labor troubles
  4. Survey of individual companies
     1. Products
     2. Wage Rates
     3. Union
     4. Turnover

4. COMPARISON OF SELECTED SITES

- A. General
  1. Shape, size, acreage; price per acre, attach a map

Departments want the installation located in a given area, state or community. The Engineering Department lays out the minimum site dimensions, both for present and future needs. The Tax and Insurance Departments have their say; so does the Traffic Department.

When needs have been made clear, and different viewpoints reconciled, the actual quest for land begins. Generally, the first outsiders to be consulted by I-P are the railroads serving the proposed area to be covered by the new plant. This is for two reasons: all International Paper plants must have a rail siding, and, secondly, we have found railroad representatives to be most knowledgable and helpful.

Almost simultaneously, however, the lines go out to state and local industrial development organizations, utility companies, local Chambers of Commerce and in some cases, other companies and individuals. We always ask—and expect—that our inquiries be treated in strictest confidence. This, for obvious reasons.

An outstanding example of our working with a railroad was International Paper's experience with the Western Pacific Railroad in the planning and construction of a 150,000-sq ft plant at San Jose, California. O. L. Hocker, Jr., the line's Assistant Industrial Agent, was notably helpful in many phases of the pre-construction activities.

Outside Help Available

When railroads or other organizations are contacted, general site specifications are made available. These provide minimum land dimension and terrain requirements . . . the size and pressure of the water line required for sprinkler fire protection and other needs . . . other utility requirements . . . necessary protection from flooding and other hazards . . . adequate sewerage . . . highway accessability . . . and other requirements perhaps peculiar to International Paper.

By now, time is a factor. A tentative schedule has been laid down covering all aspects of the proposed expansion. Deadlines have been set for site selection . . . building and other specifications, architect's plans and drawings . . . land closing . . . bids . . . letting of contracts . . . start of construction . . . plant completion and startup of operations.

Inspection teams are sent to the more promising sites which meet land specifications and other requirements. These teams consist of a representative of the Engineering Department, an expert versed and trained in land purchasing and legal matters, and a sales or management executive.

If your organization does not include a land expert, you may find it possible to make use of a reputable local real estate firm, or a member of your own purchasing department relying on local legal counsel for assistance in taking up of options and other legal matters.

After a preliminary screening, exhaustive investigation is made and detailed data assembled on the best sites. These are narrowed down to a first choice and an alternate, upon

2. Location—on a main highway?

B. Accessibility to:
   1. Power
   2. Gas
   3. Water
   4. Rail
   5. Truck
   6. Public Transportation

C. Flood Potential—Drainage of Site

D. Legal—General
   1. Zoning
   2. Building codes

5. INVESTIGATION OF AN INDIVIDUAL SITE

A. Utilities Analysis
   1. Water
      a. Static pressure and results of flow tests Will a storage tank be required?
      b. Distance from fire station, type of fire district, nearest hydrant, size of main nearest. It is a looped system?
      c. Cost of water
      d. Cost of water line to property
   2. Sanitary and storm sewer locations and size
   3. Gas available—natural-artificial; rates—regular and interruptible, BTU/cu ft
   4. Electric power—rates, penalties, discounts, service available
   5. Telephone

B. Transportation Facilities Analysis
   1. Railroads—reciprocal switching agreement and switching charges
   2. Trucks—companies serving city
      State size and weight restrictions

C. Detailed Legal Analysis
   1. Zoning restrictions
   2. Building code
   3. Easements
   4. Clear title
   5. Liens
   6. Mineral rights
   7. Existing crops
   8. Buildings and equipment located on site
   9. Advertising signs on property

D. Detailed Physical Engineering Evaluation
   1. Land survey
   2. Topographical survey
   3. Subsoil investigation — boring tests and seismic tests
      1. Bearing
      2. Water table
      3. Type soil
      4. Presence of rock
      5. Presence of methane gas

SPECIFIC DANGER POINTS TO CHECK

1. Earthquake faults
2. Undermining by coal mines (mineral rights)
3. Flood danger
4. Odors; objectionable neighbors
5. Special termite area

6. PROBLEMS OF INFORMATION LEAKS

1. Pressure of customers
2. Rise in cost of land
3. Union reactions

Illustration at left shows the site which was finally selected at Auburndale, Florida, after careful consideration of all the points outlined in this article. Illustration at lower left shows the site with its completed structure.

PLANT ENGINEER'S ROLE IN SITE SELECTION

which the cost of 90-day options is secured along with the asking price of the land involved.

These are the factors investigated and upon which final selection is based:

1. Water data—the supply available under normal and abnormal conditions, size of the water line and flow test information, water costs and restrictions, and any other pertinent data. I-P's converting plants generally require water sufficient only for sanitary and water protection purposes. But without an adequate, constant supply no plant can operate or, for that matter, even open. Fire insurance costs, too, are all but prohibitive unless the water supply meets requirements laid down by underwriters. Of course, if water is needed in large amounts for manufacturing, the necessity for concise information is even more acute.

2. Sewer data—full information on sanitary and storm sewers, along with a determination whether pumping is needed and local requirements, if any, for individual treatment.

3. Utilities and services—availability and costs of electricity, gas, telephone, garbage disposal, plant protection and food for employees.

4. Extension cost data—should any necessary facilities be lacking or have to be improved, estimates are secured on costs to bring them up to specified requirements.

5. Terrains and hazard data—information on whether the site is eye-appealing and drains well, whether objectionable operations — such as junk yards, rendering works, etc.— are located nearby, whether the site is subject to undue settling because of ground faults or abandoned mines, whether floods are a periodic threat.

6. Labor supply and wage data—to determine if the plant can be adequately staffed and with a payroll which will permit competitive operation.

7. Tax data—including land assessment formulas, special state and local taxes, use taxes, sales taxes, manufacturing taxes and other applicable assessments such as park boards.

These are points on which specific answers usually can be obtained. But full investigation also should be made of "shadow considerations" or the "business climate" of your proposed site. Sometimes more difficult to pinpoint, these factors are nonetheless very important to plant site selection.

When you are satisfied with your data, then it's back to headquarters—or, at least that's the way we do it at I-P—for another, final discussion with management of the Division which is to build the new plant. Upon the Division's approval of the site selection, another trip is made to the community. This time, with the Engineering Department representative, a Division management representative goes along, as does a top member of the Sales Department to be certain the site meets with their approval, and if necessary, someone from the Legal Department and the Public Relations section. At this time, the site is finally selected.

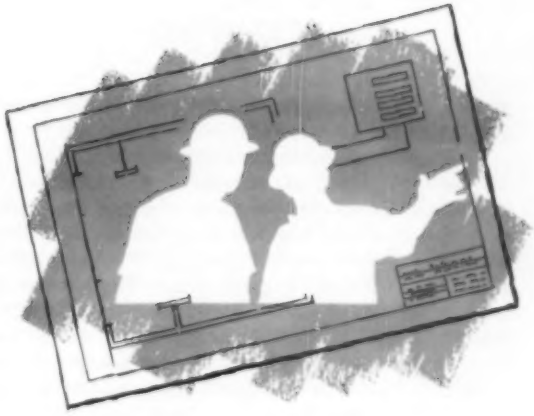
Teamwork Plus Specialists

All things considered, there is no deep mystery to intelligent plant site selection. True, it is a complex operation. It requires time, common sense and planning. But if you do these things—and if you come up with plans for the type of building you need, equipped with machinery to efficiently turn out your product, and staffed with competent people — your new plant will mean added sales and more profit to your company.

Like most other facets of business today, plant site selection requires teamwork and specialists. This is the way we strive to do the job at International Paper. Whether your company is small, medium or large—whether your proposed new site is for a low-budget warehouse or a million-dollar manufacturing center — the same steps should be followed. **End**

PLANT ENGINEERS, ARCHITECT TEAM UP ON LAYOUT

By **C. R. EKHOLM**, Project Manager, Flexonics Corporation, Subsidiary of Calumet & Hecla, Inc., Bartlett, Illinois



FOR INFORMATION and guidance on layout, services and equipment requirements, the intimate knowledge of process and equipment held by plant engineers is an invaluable adjunct to the design skill of the architect and his staff.

In the construction of our new plant in Bartlett, Illinois, this combination of plant engineer and architect was even more effective, since both "sides" consisted of a team of engineers. The Flexonics team was made up of an engineer from each of the five plants being consolidated in the new building.

Management had decided to move all of its operations and managerial direction from its five existing plants to a single facility. Each of the five plants was dependent on the other four for various production operations, engineering liaison and research and development consultation. Distance between plants created delays in a production, when two or more plants were involved.

To house the facilities of the five plants and their respective operational and managerial groups in one building and in as short a time as possible, it was necessary to set up parameters—to facilitate the move and simultaneously serve as a guide for prospective architects' and builders' proposals. As time was important it was necessary to establish a use factor for each plant process that would effectively guide the consolidation and help establish the building parameters.

One project member had studied the problem far in advance of the program and had evolved a factor of 70 per cent—which meant a 30 per cent reduction of every area, department, and lot of equipment. This 70 per cent factor was used to establish the building parameters. The varied company products, and processes involved in the manufacture of these products, indicated that parameters must be augmented by more detail, so a specification was set up to cover all major requirements for a new facility.

The intent of the specification was only to cover the size of various areas and call out items that were not common to general building practice. On the first page, the specification defines the areas of each segment of the plant and office buildings; the remaining pages specify lighting levels in each area, general conditions of heating and ventilating, required electrical services, plumbing needs, general requirements of each specific area, and special design features required by the various manufacturing processes. These specifications were issued

Fig. 1. Project Manager Ekholm, second from left, with part of his team. Plastic template was team effort.

TEAMWORK

to selected architects and builders, and their competitive proposals were set up for comparison.

After careful study, the architect-engineer firm of Ralph Stoetzel, of Chicago, was retained to design the buildings. A team of Flexonics engineers was then set up, consisting of a manufacturing engineer from our California operation, an assistant purchasing agent from Maywood, Illinois, an industrial engineer from Tennessee, a plant manager from Savanna, Illinois, and a manufacturing engineer from the Elgin, Illinois plant as project manager—all relocated in our home office at Maywood, Illinois.

One of the first functions of the team was evaluating and visiting more than 40 possible plant sites, five of which they recommended as suitable.

Plastic Grid Layout

Our team took the architect's proposal, began locating the equipment on a ¼ in. to 1 ft scale layout. This scale, while large and rather cumbersome, proved to be effective as work progressed. The layout was all on plastic grid material. Templates were inked on plastic contact template material and trimmed to size; however, the peelable backup material was left in place temporarily, the templates being held in place on the layout with small masking tape tabs. This permitted moving the templates readily until a department or group was finalized; then the templates could be peeled and adhered permanently.

An agenda was compiled, assigning an area for layout to the man most familiar with that area. There were at least five areas in progress at one time. Each was laid out separately, then combined with the others to form the large master layout.

For example, one man was assigned the plant offices and related services, the corporate offices, the cafeteria, first aid, guards and washrooms, warehousing, stores, shipping and receiving; another had the bellows manufacturing area and assembly, the "clean room" for missile components and the boiler room.

As the layout of an area was completed and approved by the team, it was transmitted to the architect for inclusion in the plant design drawings.

It became apparent that, while our records were good, there was not enough information to make good outline templates. There was a large number of machines that required every normal service, plus those that had special gases piped to them or separate electrical circuits to power them, etc. Identification became so involved that we determined to accumulate all this information for each machine on a card—which became our Basic Equipment and Services Index. See Fig. 2.

These cards were sent to the plant engineers in the five plants, to be completed. At the same time, these engineers drew up and completed most of the templates right from the equipment. These were returned to the Maywood group. Similar procedures also applied to the Research and Development Division, because of the variety of specialty items involved—again, with every type of service.

The team had to obtain, and in many instances draw up, special bases and foundations for heavy or reciprocating machinery. Handling of parts and pieces into much of this equipment necessitated a study and selection of overhead handling equipment. This study determined the need for a large overhead crane virtually traversing the building, along with a smaller transfer crane for a single-purpose handling and a number of monorails for intra-de-

FLEXONICS CORPORATION
MAYWOOD ILLINOIS

SPECIFICATION

TITLE: OUTLINE SPECIFICATIONS FOR A FLEXONICS CORPORATION BUILDING TO BE BUILT ON AN ASSUMED LEVEL AND CLEAR SITE.
APPROXIMATELY 800,000 SQUARE FEET.

1.	Main building proper	300,000 sq. ft.
1.1	Main building basic breakdown	
1.1.1	General manufacturing area	217,000 sq. ft.
1.1.2	Warehouse and stores	30,000 sq. ft.
1.1.3	Plant offices	25,000 sq. ft.
1.1.4	Corporate offices	27,000 sq. ft.
2.	Yard and parking lot	
3.	Research and Development area May be a separate building or attached to main building pending which is most advantageous, both from initial cost and practicality of operation. 12,000 sq. ft. lab, 12,000 sq. ft. offices. 16' height clear	24,000 sq. ft.
4.	Site	

Personnel (Rev. 6.)

	M	F
Office	250	145
Factory	320	70
R & D	90	10

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PREPARED BY: C. E. K. — DATE 1-26-60 — SHEET 1 OF 9

Fig. 2. First page of outline specifications presents general requirements. Following pages detail separate areas.

partmental handling into processing tanks, assembly areas and raw material.

As progress was made, it was determined that the heavier and larger products should have the best access to receiving and shipping areas and were so located to minimize heavy handling. And, other products, as they became smaller and lighter, were located progressively further from receiving and shipping. This had additional merit, since the small, light products generally went through more processes and quality control centers than the heavier products and normally had to travel a greater distance. This information, too, was relayed to the architect for his consideration in plant design.

Many of the small, light (and some not so small) products have to meet clean requirements of a very low micron level. A clean area was designed to handle parts up to 30 ft in length; it is actually a series or rooms, each built to environmental compatibility of the particular requirement of that area.

Recirculating Cooling Water

In some of our processes, a large amount of water is used to cool furnaces, welders, test equipment, etc. As machines may have to be moved to accommodate future innovations in processes and modes of production, it was decided to trench certain areas of the plant floor to pick up, filter, cool and recirculate this water in a type of closed system. This would greatly reduce jacket scaling, reduce temperature shock in equipment and conserve water. This resulted in a further use of the Basic Equipment and Services Index cards.

The architect and mechanical engineers took full advantage of our layout; to reduce time in effecting building and services detail, a duplicate set of the cards was supplied to them to help them determine service loads throughout the plant. This minimized their need to become completely familiar with our type of production to design the optimum plant, aesthetically and functionally.

Later, the card information was put on each template on the layout—or in cases of small pieces of equipment, adjacent to the template. This would have been very difficult on a layout smaller than ¼ in. to 1 ft. The cards will ultimately become a part of a master file in conjunction with mechanized accounting listings.

During design, spatial relations with offices and managerial groups were constantly considered. The offices were assigned to one man to coordinate and lay out—with those groups having most contact with production being the closest to the plant proper, etc. Purchasing was given immediate access to the main lobby, as they contact the most visitors to the facility.

The 70 per cent factor and the parameters proved to be extremely accurate, with only one unanticipated shortage after the building design proper was frozen. This shortage was remedied by adding boiler room area to accommodate plant service equipment.

The team concept worked very well, and I am confident, backed by the ability of the team, that the layout is workable in every respect. Some operating groups felt their locations should be changed and some were, at least for a trial, to determine if benefits were to be gained by all groups involved in the change. In some instances the changes were permanent.

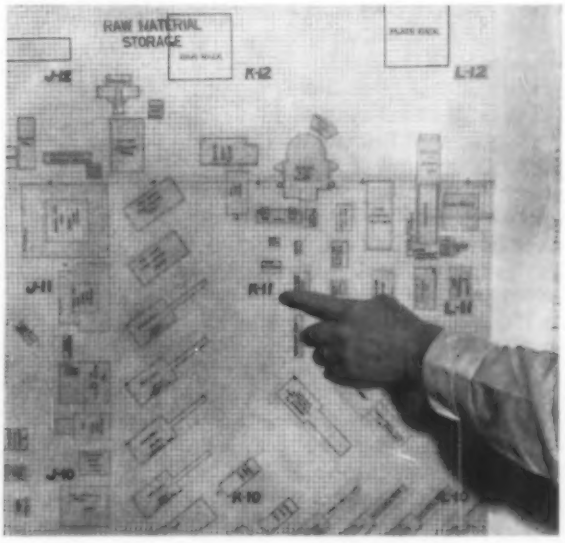
The team served as an immediate source of information for the architect; they served as a guide to him, so that no phase of the project got much past the sketch stage before errors were caught. They also checked all drawings at various stages of completion.

Both groups, the Flexonics team and the men from the Stoetzel firm, kept constantly in mind the need to provide for future expansion of the plant.

Although our plant team was not empowered to sign any documents or participate in the building of the plant, it served as highly valuable liaison between company and architect. In this liaison function, it contributed much to the rapid and accurate completion of the layout and drawings so vital to construction of the new plant. **End**

Fig. 3. Typical example of Basic Equipment and Services Index Card. Cards were valuable tools in laying out plant.

Fig. 4. Oversize plastic grid, with machine templates, was time-saver. Information came from all five plants.



PLANNING . . . DESIGN . . . CONSTRUCTION . . . OF AN INDUSTRIAL PLANT

BY PLANT ENGINEERING AT R. J. REYNOLDS TOBACCO CO.

By **K. T. SPEER**, Superintendent, Construction & Maintenance Div. R. J. Reynolds Tobacco Co. Winston-Salem, N. C.

PRIMARY RESPONSIBILITY for construction of R. J. Reynolds plants—from the investigation prior to the decision to build to the completion of construction by our craftsmen—rests with the Engineering Department. Our Chief Engineer serves on the Company's Real Estate, Building, Machinery and Equipment Committee, and participates in all construction decisions; he also directs engineering investigation of potential plant sites, by his own staff and specialized consultants such as soil physicists, topographical surveyors, hydrologists, etc.

To illustrate this Engineering Department responsibility in a construction project, this article will follow the progress of our new Whitaker Park plant in Winston-Salem, N. C., currently under construction. Covering 592,000 sq ft, excluding the steam plant and utilities building, the plant is a $30,000,000 addition to our cigarette-producing facilities.

To initiate a project of this type a "Request for Engineering Study and Estimate" is prepared by the Operating Department primarily concerned and forwarded to the Chief Engineer. It is immediately assigned to the Engineering Technical Division for development of scope, drawings requirement, and estimate. In a project of this size, a liaison group is usually formed, made up of representatives of Engineering, Manufacturing, Leaf, Industrial Engineering and certain other staff departments. Mission of the group is to study and make recommendations as to building layout, special processing and manufacturing equipment, space requirements, traffic problems, etc.

The engineering estimate, produced by the Technical Division's estimating unit, includes materials, equipment, and manpower by crafts, to produce the new plant. Estimating data include historical records, statistical and standard data.

The completed estimate and Study Report support a Request for Authorization, which is reviewed and approved by the Real Estate, Building, Machinery and Equipment Committee, and, in the case of major projects, as this one, the Board of Directors. The approved document is returned to the Engineering Department marked, "Please Proceed".

The new plant is now identified as "Project 2890", and is assigned by the Chief Engineer to the Engineering Coordinating Unit for development of drawings schedule, specifications, and a construction schedule. The project

Fig. 1. Radios carried by fie'd supervisors speed contacts with office.

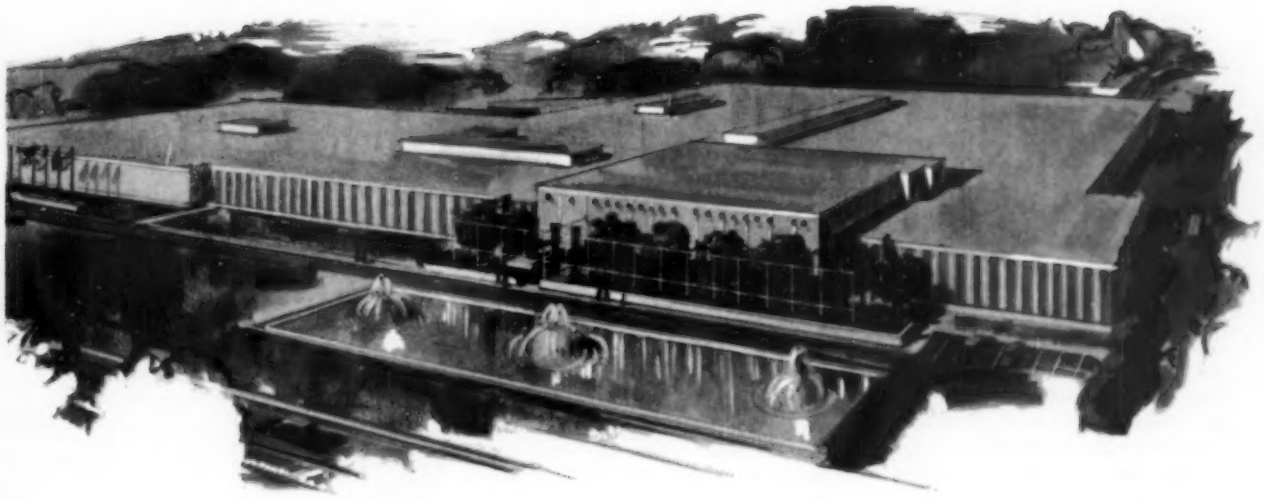


Fig. 2. Exterior "stripes" are contrasting colors of precast concrete curtain wall panels. Except for pool and entry decor, plant was designed by Reynolds engineers.

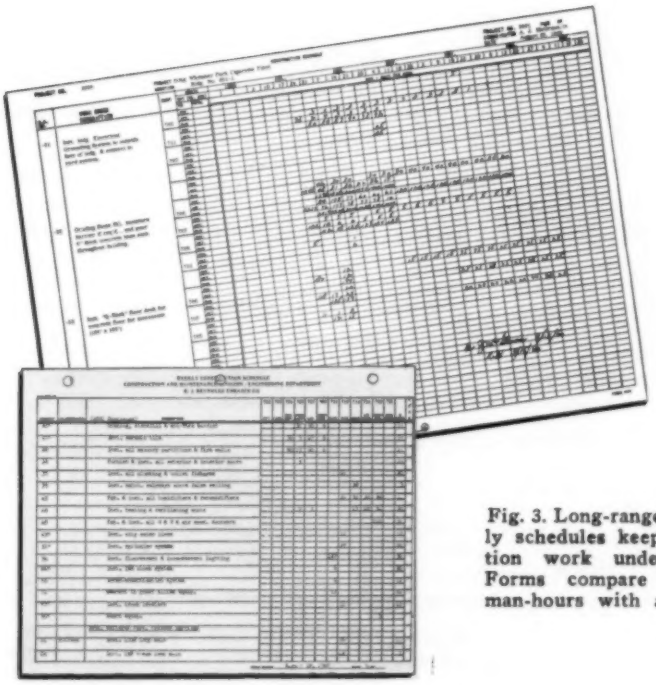


Fig. 3. Long-range and weekly schedules keep construction work under control. Forms compare scheduled man-hours with actual use.

is assigned to an Engineering Coordinator, and a staff of engineers, technical clerks and stenographers is formed to handle the responsibilities of procurement, specifications, approval of drawings, cost control, and preparing a construction schedule.

At this point, the scope of the new building and its function, the design of the interior and exterior, and the over-all scheduling of the project has been completed.

And, in keeping with our philosophy of engineering control, the entire job has been handled by our own Engineering Department. Certain specialties, of course, are contracted out—the use of soil experts already mentioned, the design of the power plant (but not its construction) and the design of the main entry ornamentation.

Project 2890 is now ready for groundbreaking, and the project is assigned to the Construction and Maintenance Division.

This Division is the construction contractor for our Company. Historically, the primary mission of our Construction and Maintenance Division is maintenance support to all operating divisions, but the construction responsibility and capability is not new. All construction of manufacturing and leaf facilities in the Winston-Salem area in the last thirty, or more, years has been accomplished by our Engineering Department. The expansion to accommodate an accelerating program has been systematic and orderly.

The Construction and Maintenance Division is made up of four units with the total workload almost equally divided between construction and maintenance. The maintenance load is in proportion to total facilities so as we build we are adding to this load.

There is no separation of "maintenance" and "construction" personnel as such. We feel this is a major advantage. The mechanic erecting the building or installing the machinery has usually had maintenance experience, and is sensitive to future maintenance requirements. In fact, his next assignment may well be with a zone or shop responsible for maintenance of the installation being made. A large number of maintenance-reduc-

PLANNING DESIGN CONSTRUCTION

ing modifications are the result of recommendations and suggestions by mechanics and supervisors.

We are organized as shown in Fig. 4.

Construction coordinators, responsible to the Assistant for Construction, provide staff assistance in coordinating the efforts of all shops. On large projects, an on-the-site supply section responsible to the Supply Manager provides receipt, storage, and issue service for all materials, equipment and supplies. This section also provides temporary storage, if necessary.

The problems connected with a rather high rate of expansion—twelve per cent per year for the last ten years—are those you would expect. It was necessary to find additional supervisors for all levels. Additional equipment, from tube benders to medium size cranes, was gradually added. It has been necessary to expand shop facilities and storage space for supplies, and to develop more sophisticated inventory control methods. I will describe some of these problems and describe methods of handling them.

Supervision—About 90 per cent of the vacancies created by expansion in manpower (approximately 200 per cent in the last five years) have been filled "from the ranks" by mechanics with several years of experience. About ten per cent have been filled by graduate engineers transferred from our Technical Division, and by two-year technical school graduates employed as apprentice mechanics. Our supervision density is, as yet, not up to par and we must utilize "lead men" and "temporary assistants" as a part of our development and training of potential supervisors.

Field Coordination—As many as twelve craft shops and a supply unit on this major project at one time keep two construction coordinators hustling. Actually, they could not function effectively without the complementary coordinating effort and cooperation of each shop. Weekly appraisals of percentage completion of each work order are made on the job. This provides a continuous picture of both progress and effectiveness, i.e., performance against the estimate.

Supply—Our supply unit on-the-site has complete responsibility for receiving, reporting, temporary storage if needed, and issuance to the using shop on Material Requisition as needed. This unit is responsible to the Engineering Supply Manager and is backed up by our $2,000,000 supply unit stores. A file of materials delivery status by work order is maintained on the job site. As an additional service, the supply unit coordinates on-site and off-site transportation facilities including trucks, trailers, and personnel carriers. Radio dispatching is employed for all vehicles except those restricted to the project site.

Scheduling—Weekly scheduling, subsequently covered in more detail, is a must for effective construction

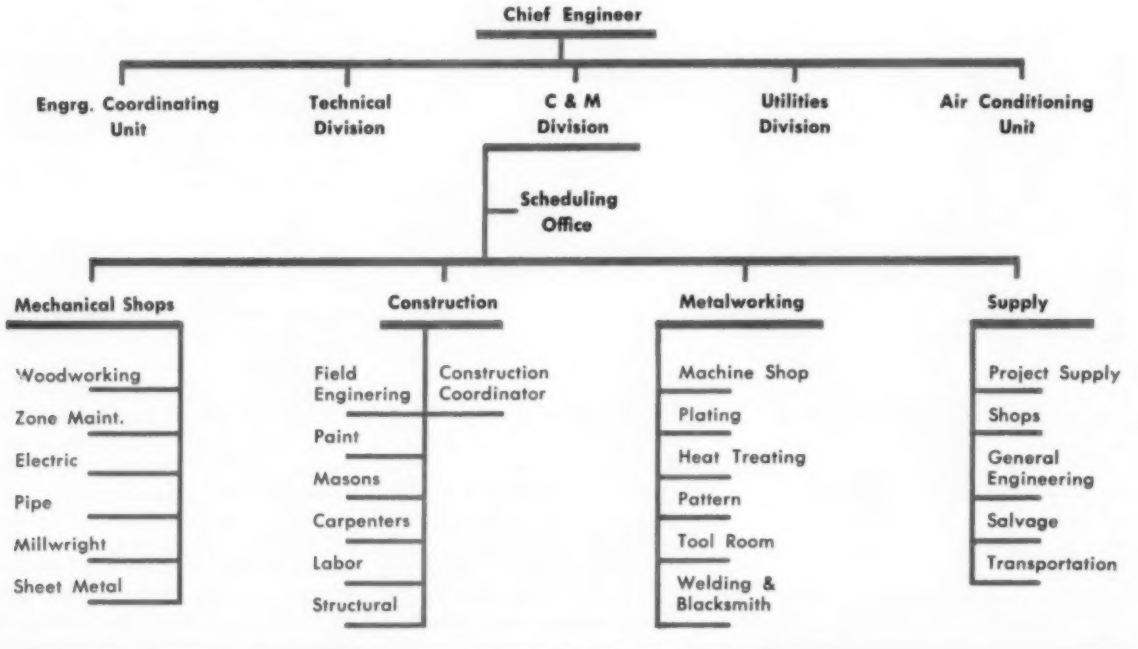


Fig. 4. Engineering department is composed of five general divisions, all involved in new plant planning. C & M Division, outlined here, has responsibility for carrying out all construction activities of company.

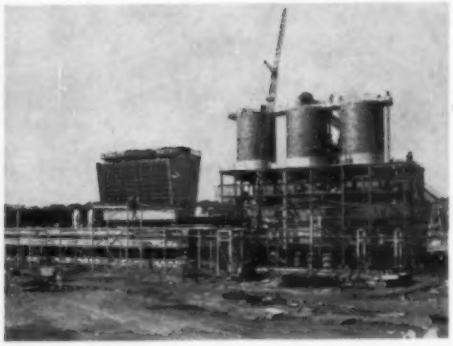


Fig. 5. Steam plant and utilities building (housing refrigeration equipment) were also constructed by C & M Div.

Fig. 6. Over-all construction shot shows extensive use of roof areas for equipment to service operating floors.

effort. Each shop manager, with the help of the construction coordinators, supply manager, engineering coordinator and liaison with other shop managers, predicts next week's work. The results are effective and accurate beyond reasonable expectation.

Communications—On major projects such as this, hand-carried radios are used for on-the-job communication between supervisors, construction coordinators, supply, and field offices. See Fig. 1. Temporary telephones, connected to the Company central (downtown) switchboard, provide communication between downtown and the job site.

The construction schedule, Fig. 3, is prepared by the engineering coordinator, provides primary guidance as to sequence of work and manpower requirements. Each proposed schedule includes a "summary" showing total manpower, by crafts, for each week. This is matched against a Weekly Manpower Status Report showing manpower "available for construction" for the following 78 weeks. (Total manpower by shops less allocations for Repair Orders, Standing Orders, vacation, jury duty, sick time, etc.) The project is either phased into existing manpower capabilities or placed in schedule in consonance with a "must" target date. The latter handling, which usually happens on larger projects, may immediately show up a manpower requirement by a minus availability on the Manpower Status Report.

Future manpower requirements, based on a composite of all construction schedules, maintenance requirements, vacations, etc., are furnished our Personnel Department periodically.

The final Construction Schedule is approved by Construction and Maintenance, incorporated into our backlog, then printed and issued to each shop. The schedule is followed as closely as possible. Deviations caused by minor delay of drawings or materials, or temporary lack of manpower are handled without revisions. Revisions *are* made when a major change occurs that will force construction to be substantially out of phase with the schedule. This is handled by the Engineering Coordinator as a new schedule, i.e., the original schedule is removed from the Status Report, shop work sheets, etc., and the revision inserted.

Weekly Scheduling

A "large" project, like this cigarette plant, involves several hundred individual work orders. The completion of drawings and delivery of materials estimated several months ahead of the construction start will not be exactly as predicted and many deviations from the construction schedule will be necessary. We meet this problem by "weekly scheduling".

On Tuesday of each week, each shop is furnished a "tentative schedule" listing all work orders taken from current construction schedules showing manpower scheduled for the following week *plus* a list of work orders on which work was done the previous week but not appearing on the construction schedules (ahead of or behind schedule) for the week concerned. This list is reviewed by the shop against available drawings, and other necessary information, materials, equipment, and manpower. It is also coordinated with other shops when two or more shops are involved on the same work order.

The "tentative schedule" is simultaneously reviewed by the engineering coordinators who indicate concurrence or request a deviation and advise the scheduling clerk.

On Thursday morning, the combined effort of each shop and each engineering coordinator becomes a final schedule for the following week when a shop representative meets with the scheduling clerk. The manpower needs of the various projects as indicated by the construction schedules and the engineering coordinator are reconciled with manpower available and necessary information and materials. This is printed Friday morning and issued at the Construction Progress Meeting.

On Friday morning of each week, the Construction and Maintenance Division Superintendent presides at a construction progress meeting attended by the assistant superintendents, all engineering shop managers, engineering coordinators, the chief coordinator, and the Chief Engineer.

The current week's schedule is reviewed by Work Order, and each shop representative reports performance in man days. Excessive deviation from the forecast made the previous week is questioned and explained.

This meeting is also used effectively in communicating face-to-face with all shop managers. New work authorizations, current work backlog in total working days, and the manufacturing schedule for the next week are reported.

The management controls and methods exercised through systematic scheduling, weekly appraisals and scheduling, periodic ratio delay studies, and continuous study and surveillance by senior managers and engineers have proven to be very effective. Our shop supervisors and mechanics, with years of experience and familiarity with all types of tobacco processing and manufacturing equipment, make a major contribution to our construction effectiveness.

This effectiveness has reinforced that of the engineering groups which designed the plant, specified the materials of construction and scheduled the entire project, to make Whitaker Park a highlight in Reynolds' plant construction history. **End**

PROJECT CONTROL

CONTROLLING MONEY, TIME AND MANPOWER

By **R. E. WRIGHT**, Director, Engineering and Development, Chemstrand Corporation, Decatur, Alabama

PROJECT CONTROL is a method by which money, manpower, materials and time are managed, to produce an industrial plant—on time, within a budget.

Project control is basically a systematic method of comparing plans with actual performance, and the method will vary with the type of contract under which the project is being built. Two major contract types are used: cost plus fixed fee, and lump sum or straight fixed price. For the purposes of this article, we will discuss a cost plus fixed fee contract, and the controls that can be set up for it.

The man responsible for project control is the engineer who is normally responsible for process, design and construction. He is known by various titles in various organizations—plant engineer being most common—but at Chemstrand, we speak of the man responsible for a construction project as the project executive.

He must coordinate the functions of process, design and construction so that these three groups function smoothly; if these people do not function with proper timing, the project is at least partially out of control.

On a large project (i.e., above $1,000,000) the execution and control of the project are delegated to the following groups:

Process group is responsible for the project scope, the preparation of the

TYPE OF CONTRACT	OWNER CONTROL SYSTEM	CONTRACTOR CONTROL SYSTEM
1. Cost plus fixed fee contract	Requires excellent owner control system	Relatively simple contractor control system, mainly to control manpower and unit costs
2. Lump sum contract	Requires owner inspection only to assure conformance to plans & specifications	Requires an excellent contractor control system
3. Guaranteed maximum price with participation in savings	Requires owner control system at least as good as Contract Type 1	Requires contractor control system about as good as Contract Type 2
4. Fixed price set after completion of early engineering	Requires owner inspection to assure conformance to specifications	Requires contractor control system about as good as Contract Type 2

Table 1. Construction contract types, and project control methods best suited to building owner, contractor.

basic data for design and keeping up the Machinery and Equipment list.

Design group is responsible for requisitioning and selecting equipment, and preparing detailed drawings and specifications. They handle structural, architectural, mechanical, piping, electrical, and instrumentation design.

Construction Group

Construction group is responsible for selection of contractor, supervision and inspection of construction work, all relationships with the contractor, inspecting, expediting and receiving equipment ordered by the owner. An independent part of this group which is not concerned with execution is responsible for estimating, scheduling, cost analysis and progress evaluation.

Purchasing group is responsible for securing bids and quotations and placing purchase orders on M & E items, and for staff supervision of contractor purchasing.

Accounting group is responsible for accumulating and reporting of costs, auditing of contractor's accounts and payment of invoices.

The contractor is responsible for all construction activities as directed by plans, specifications and field orders.

Chart I is a schematic representation of a project control method which can serve as a guide in controlling basic objective, money, time, manpower, and materials. The chart shows those phases that require control, and indicates the control activity necessary.

The controlling action by the project executive is shown in the chart, in the last column to the right.

Regardless of his skill and effectiveness, the project executive must delegate many functions of control to others. Some of these functions and the personnel responsible are:

An estimating engineer should analyze monthly the cost report and give the project executive a report on the financial status. He should also check selected unit costs to appraise project effectiveness, and he is responsible for re-estimating the project at the 60 per cent stage of completion.

A scheduling engineer should analyze the monthly construction schedule and report on the physical progress. The specific work of this engineer would be a determination of the per cent of physical completion each month.

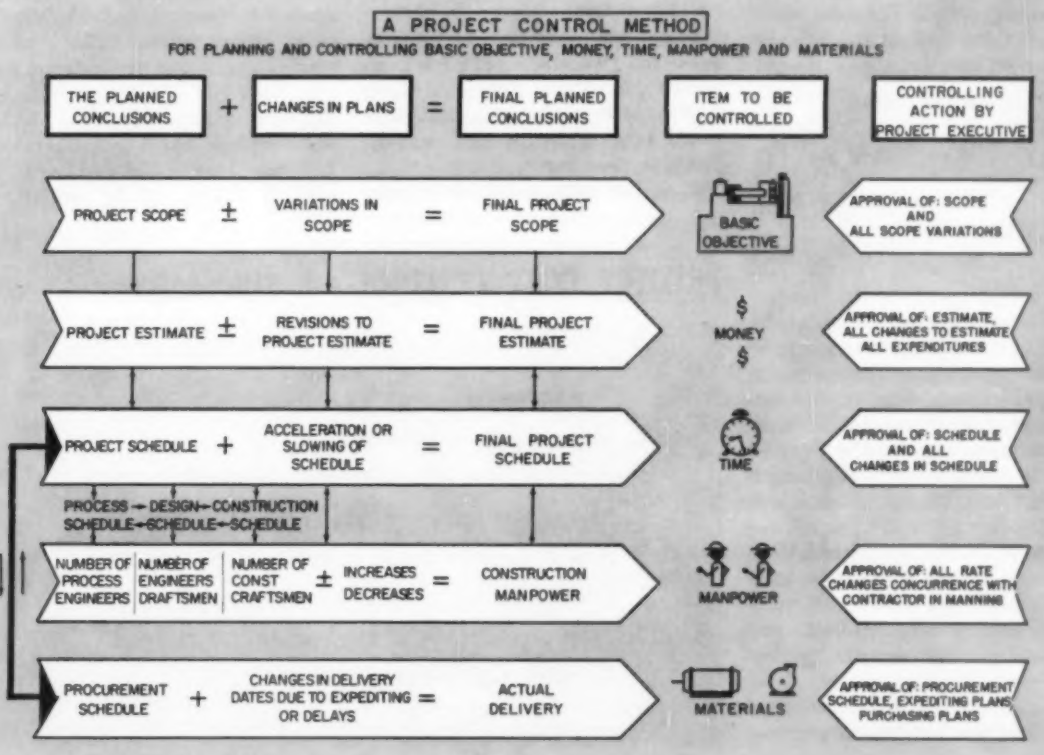
A scheduling engineer should analyze daily, weekly, and monthly statements of construction manpower, to report planned vs. actual manpower and suggested changes in manpower. His specific work is the calculation of appropriation for manpower to meet change in schedule or other variations.

The Summary Report

Countless reports can be made to the project executive, but the indicators that reveal most clearly the status of the project can be presented on a Summary Report, as shown in Chart II.

In broad outline, this summary report contains highly significant data on the money, time, and manpower status of the project. In terms of money, it gives the total current appropriation for the project and seven key indicators of costs and per cent of estimated costs. In terms of time, it gives two significant indicators of planned vs. scheduled progress. In terms of manpower, it gives a graphi-

Chart I. Schematic diagram of typical project control method shows how various conditions and adjustments interact.



cal portrayal of the scheduled manpower vs. the actual manpower. It also gives a statement of unvouchered liabilities, a very important factor sometimes neglected that will be specifically described later. At the bottom of the report, space is provided for a check list comparison of some of the money indicators and a specific statement on the status of the project with respect to time and manpower.

Using this report, weighing it against the factors that cause a project to go out of control, the project executive can increase his effectiveness in control.

The Project Estimate

The project estimate is not what is commonly called "blue sky", "preliminary", or "appropriation grade" —it is an estimate with a high degree of accuracy, prepared only after the project scope is well defined.

When this estimate is being prepared, all items are identified by an accounting code number, which enables the estimate to be readily totaled to show many details. The code, whatever its structure might be, provides the following information:

1. The specific project.
2. The area within the project.
3. The cost element or work category.
4. Individual equipment pieces or pipe lines.
5. Components of equipment pieces.

The same code used for estimating is used in purchasing equipment, by craftsmen reporting their time charges, and in all financial transactions during the project. Thus, the construction cost report is eventually reported in exactly the same form as the project estimate.

During the course of a project, the estimate is continually reviewed. Each month the estimating specialist tabulates the changes in the estimates, showing the net effect on contingencies, for approval by the project executive.

When the physical completion of the project reaches the 60 per cent stage, a complete re-estimate should be made. At this 60 per cent stage, all equipment has usually been purchased, so actual costs are available; at least half the labor has been expended, so estimating data can be improved. And, omissions in earlier estimates will show up—as will omissions in early design work.

This re-estimate will almost positively reveal the probability of a serious overrun on the project, regardless of the cause. Fortunately, there is still time for corrective action, whether it be request for supplemental appropriation, the institution of strict economy measures to pull costs back into line, or rescheduling of the job for more economical results.

A construction cost report, in its simplest form, is a statement of expenditures plus commitments. Usually, it is made by major items or departments. The form and content of the report may vary but the sum totals must include at least four figures: total labor, total materials, total commitments, and total expenditures plus commitments.

It is also helpful if some of these figures are expressed as a per cent of the total estimated amounts. These figures, compared with physical completion percentages, make excellent indicators of project status, and can provide a revealing view of the project. For example:

1. A high percentage of commitments and expenditures at a low completion percentage stage can signal trouble; the corrective action here would be a review of cost vs. estimates, or re-estimate.

2. A low percentage of commitments and expenditures at a low completion percentage stage can indicate inadequate process in ordering equipment and materials.

3. Low expenditures with high commitment can mean that deliveries are slow, or bills are not being paid promptly.

4. Large outstanding commitments at a late stage of per cent completion can also indicate that bills are not being paid, or that some major items will delay the project.

5. If per cent of labor expenditures is running proportionately higher than the per cent of physical completion, this signals high labor costs due to poor planning or excessive overtime.

6. Per cent expended and committed compared to per cent complete and per cent scheduled to be complete can indicate exactly what it should—that a project is on time and on the money.

Unvouchered Liabilities

Among financial matters of concern to a project executive, unvouchered liabilities need particular attention. These liabilites include any unpaid charges such as invoices, freight bills, inter-plant charges and debit memos, all of which have been received and should have been paid, but have not. From a control standpoint, failure to account for unvouchered liabilities can cause serious trouble. The total expenditures and commitments can compare favorably with the estimate, and can show up favorably in the percentage complete; but if unvouchered liabilities add up to a large amount, the over-all picture can be seriously in

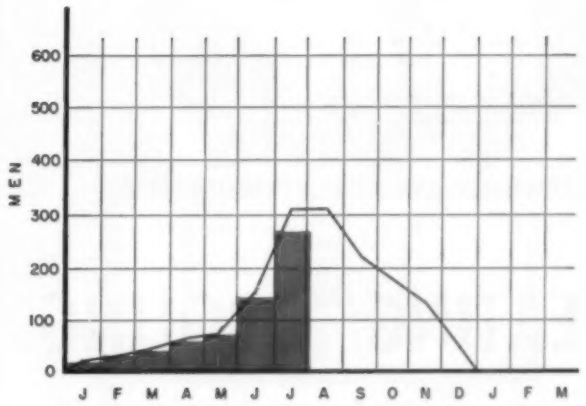
PROJECT COST CONTROL—A SUMMARY

1. The scope of the project is defined
2. The project is estimated
3. A completion schedule is determined
4. Manpower requirements are determined
5. Any change in scope is authorized
6. Project is re-estimated at various stages
7. Project schedule is studied and re-studied
8. Construction cost report is analyzed

SUMMARY REPORT
Status of Project Time, Money and Manpower

Name of Project ED-5142 Date 10-30-59

1) Total Current Appropriation	$ 3,338M
2) Total Labor Cost To Date	$ 403M
3) % of Estimate Total Labor Cost	32
4) Total Materials To Date	$ 453M
5) % Expended for Materials	22
6) Total Commitments to Date	$ 721M
7) Total Expenditures plus Commitments to Date	$ 1,577M
8) % Expended and Committed	47
9) % Physically Complete	38
10) % Scheduled to be Complete	38
11) Unvouchered Liabilities	$ 74M



MONEY	OK	Not OK
Item 3 vs. Item 9	✓	
Item 1 vs. Item 7	✓	
Item 8 vs. Item 1 less 7	✓	

TIME
Project is:
- ☐ Ahead of Schedule
- ☒ As Scheduled
- ☐ Behind Schedule

MANPOWER
Number of Construction Workers are:
- ☒ Below Scheduled Number
- ☐ As Scheduled
- ☐ Above Scheduled Number

Chart II. Accurate compilation and careful study of summary report sheet such as this make it almost impossible for project to drift out of project executive's control.

error. To illustrate, assume this case:

Total project estimate	$10,000,000
Total expenditures ...	4,000,000
Total commitments ...	5,000,000
Total expenditures & commitments	9,000,000
Unvouchered liabilities	1,500,000
Scheduled per cent complete	85
Actual per cent complete	80

Without knowledge of unvouchered liabilities, the project looks good. But, if it is known that these liabilities amount to $1,500,000, and actual expenditures should be listed as $5,500,000, the project executive may recognize an overrun situation, and take immediate corrective action.

In a cost plus a fee contract, it is desirable to have an occasional check of the contractor's payroll. One way to do this is to have an owner's representative witness the handing out of paychecks, to avoid payroll irregularities, which may not even be known to the contractor himself.

Each month, the construction area engineers should make an appraisal of the percentage of physical completion, by judging the amount of actual completion for each work category in each construction area.

The scheduling engineer should then weight these percentages by the total estimated cost in each category. If these determinations are made for many work categories, and properly weighted, the total per cent complete can be a very accurate figure.

Purchases By Owner

In the cost plus fixed fee contract, where the owner does the engineering design, all major equipment should be purchased by the owner's engineering force. Most of the items are usually closely identified with the process, and the owner's engineers are best qualified to specify it.

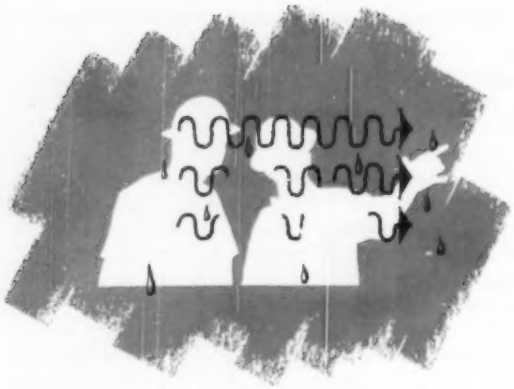
Purchase of machinery and equipment should be handled in this way: the general performance specifications are prepared by the process engineers, the design engineers write specs and request quotations, tabulate bids, select vendors and prepare requisition to the purchasing department.

This sequence of events, too, should be controlled. Index card systems are adaptable to this control, tabbed to indicate progress of each item.

Getting projects started is not the only difficult phase; getting them stopped can be as hard. No matter how effective the clean-up, there are always minor items undone. To minimize the contractor's entry into maintenance work, or work outside the scope of the contract, control is needed.

As soon as the construction area engineer is satisfied that his area is complete, he should tour it with a member of the operating group. Their detailed report of all deficiencies puts a definite limit on the final work required to close the contract, and serves as a check list to the contractor.

After all items on the deficiency list have been completed, a notice of completion is sent to the operating group, and a release is signed. **End**



HEATING, COOLING AND HUMIDIFYING PLANT AIR

By **V. E. PETERSON**, Plant Engineer,
Personal Products Corporation, Wilmington, Illinois

NEW CONCEPTS in air conditioning, humidifying, and plant construction detail have been combined in our plant now being built in Wilmington, Illinois. Outmoded construction in our Chicago plant (which is being replaced by the new facility) did not permit proper air conditioning or humidity control; varying climatic conditions sometimes led to erratic production, while heat and lint contributed to the housekeeping problem and to employee discomfort.

Two of our goals in moving operations to a new plant were to obtain a building suitably constructed for accurate control of humidity and temperature, and to obtain the most functional and flexible layout possible.

Highlighting the functional aspect of the plant design is a 380,000-gallon reflecting pond with spray nozzles, at the entrance to the office building. The pond takes the place of an outdoor tank for storage of water for fire protection. In addition, water from the pond, cooled by spray nozzles, will be circulated to the air conditioning units, air compressors, and other units requiring cooling water.

The service area is located beneath the first floor office and the connecting building between office and plant. Here are located the boilers, water and fire pumps, emergency generator set, telephone equipment room, power panels, air compressors, and many other permanently set facilities. The basement location of the service area permits layout changes in the production and warehousing areas and facilitates expansion of the plant in three directions.

Designer of the new plant, architect Ralph Stoetzel of Chicago, took great pains to ensure maximum space utilization. The roof structure consists of 24-inch wide-face I-beams supported by columns on 45-foot centers.

Twelve-inch I-beams are used as

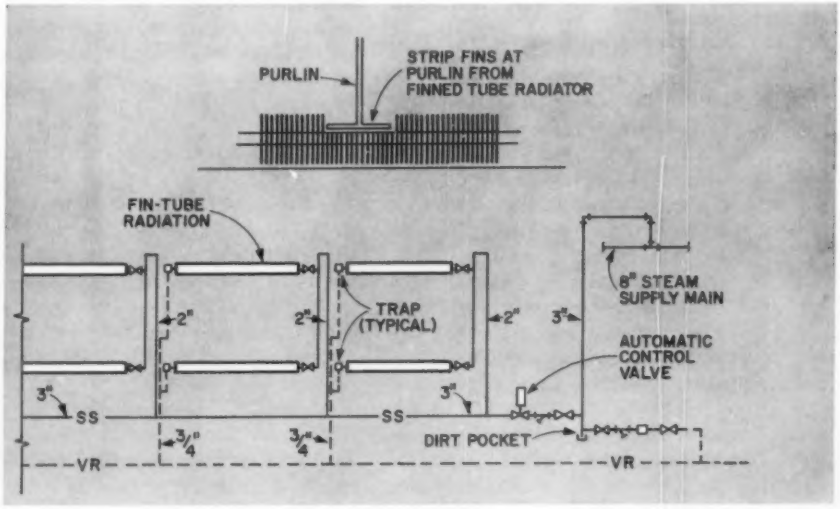


Fig. 1. Piping for fin-tube radiation heaters above and below windows. Inset, radiator fin detail at purlin.

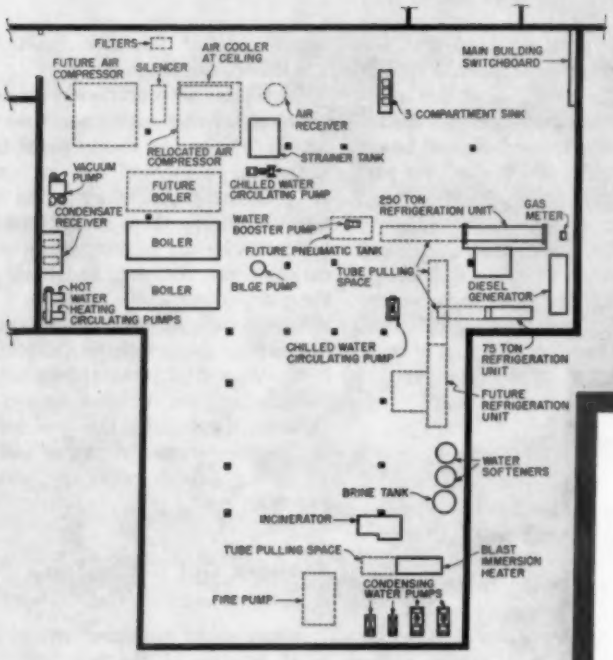
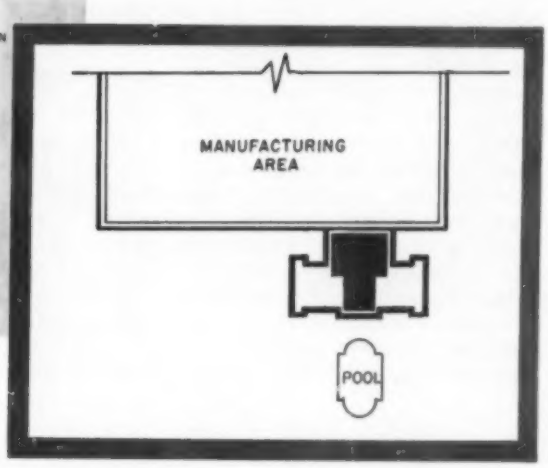


Fig. 2. Floor plan of basement service area shows equipment locations. Pumping and chilling machinery links pond with interior cooling systems.

Fig. 3. Partial layout of manufacturing plant and office, with location of service area blocked out. Location of reflecting pool is also indicated.



purlins on 7½-ft centers supporting a steel pan roof deck. All utilities—lights, steam lines, sprinkler lines, etc. —are located above the lower flange of the 24-inch I-beams, permitting the maximum usage of cubical area for 20-ft high stockpiling. This construction was inexpensive to build and will save a substantial amount in warehousing costs.

Climatic conditions play a big part in this manufacturing operation, because the production process involves movement of thin paper and fibrous materials under tension. The tension these materials can withstand varies with atmospheric conditions, especially humidity. Accordingly, several steps were taken to insulate the manufacturing areas as completely as possible, and to carefully regulate humidity, filter the air, and control temperature.

The walls of the production area are specially designed to withstand temperature and humidity gradients between their inside and outside surfaces. Exterior walls of these areas are of white speckled glazed brick, with Waylite autoclaved block backing it up.

Secoton plastic film is used as moisture barrier and insulator. Actually there are five elements in the wall, as shown in Fig. 4; the plastic film is on the inside face of the wall, adhered to a course of block; next, a layer of Styrene foam insulating material, then another course of block, and finally the outside brick.

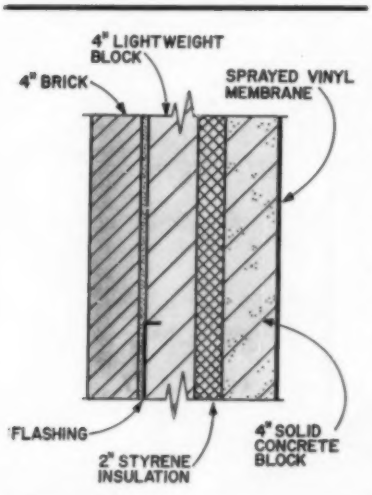


Fig. 4. Cross-section of building wall shows five-layer construction to decrease thermal, moisture transmittal.

The roof is insulated with a layer of plastic sheet for a moisture barrier, two inches of spun glass insulation, and finished with a built-up roof of felt, tar and gravel.

Continuous windows, which are installed just under the roof cornices around the entire plant, are specially fitted to resist the formation of condensation on their inside surfaces. In the production areas, fin-type heaters have been placed above and below the line of windows to keep them dry.

These several varied insulation devices and techniques will make it possible to maintain 55 per cent humidity in the plant, even when outside temperatures are at O F.

In the past, most similar plants have used large bulky air washing equipment to humidify the air in their manufacturing areas. These units were permanently set and took up a large amount of floor space.

In an effort to find a more practical and economical system, Personal Products' plant engineers, with engineers from the architect's organization, visited existing plants and investigated a number of units that would filter, heat or cool, and humid-

HEATING, COOLING . . .

ify air, under automatic control. The unit selected was Carrier Corporation's Roto-Spray unit.

Relatively small and compact, these units were installed without additional structural support attached to the building framing. They can be readily moved from one area to another, as new manufacturing layouts may be introduced.

Four units have been installed in the manufacturing area. Each has a capacity of 20,000 cubic feet per minute. They are hung from the ceiling, with ducts attached to evenly distribute the conditioned air throughout the manufacturing area. Each unit services approximately 14,000 sq ft of area, giving a uniform temperature and humidity, regardless of outside weather conditions, by means of specially-designed thermostat and humidistat controls.

In operation, outside air is proportioned with return air through an air-mixing chamber on the intake side of the unit. The axial fan at the entering side of the spray chamber directs the air mixture through several banks of spray nozzles which eject lint particles through a special self-cleaning mechanism. At the end of the spray chamber, a rotating eliminator wheel slings out water droplets and foreign matter through centrifugal force, permitting the clean conditioned air to pass through with a minimum of static pressure.

Self-Cleaning Units

Water and entrained foreign particles drain from each unit into a common combination collection and separation tank, where cylindrical strainer automatically removes foreign matter for subsequent disposal.

Water from a 250-ton chiller washes, cools, and de-humidifies the air for summer air conditioning. In winter operation a heater on the discharge side of the unit heats the humidified, conditioned air.

Since these air conditioners are self-cleaning, the only maintenance we expect is (1) periodic checks to see that equipment is in good working order and (2) changes of water in the system once every three to six months. Estimates by the architect's mechanical engineers, Kralovec and Best, put the maintenance costs for these units at about one-sixth that of units with dry filters. And, with humidification of the air a vital consideration of our installation, the built-in sprays of these units precluded the need for an additional source of water which would have been necessary with a dry filter unit.

Features Cut Costs, Too

Many of the most modern and efficient features of the new plant, although they embody the latest improvements in plant engineering and architectural design, at the same time represent sizable savings in construction and maintenance costs. Using water from the attractive reflecting pond for cooling purposes (it is the primary source for water in the closed cooling system) will save approximately $1500 a year in water costs. Controlled temperature and humidity conditions in the manufacturing areas, the year round, will effect a saving of approximately $8000 a year, through improved machine efficiency, better housekeeping and improved employee efficiency. **End**

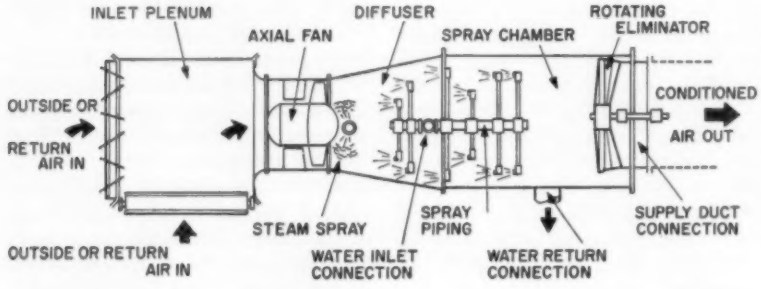


Fig. 5, above. Cross-section of conditioning unit installed to control critical temperature and humidity levels in manufacturing areas.

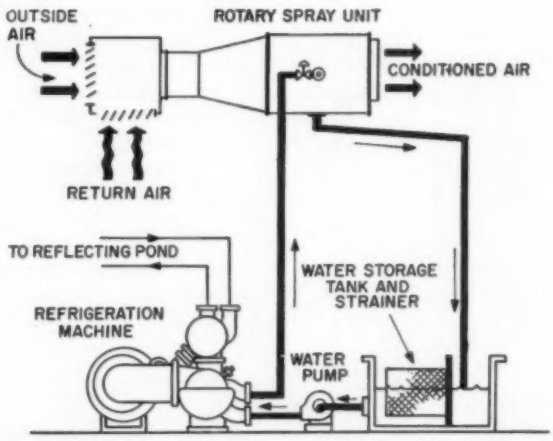
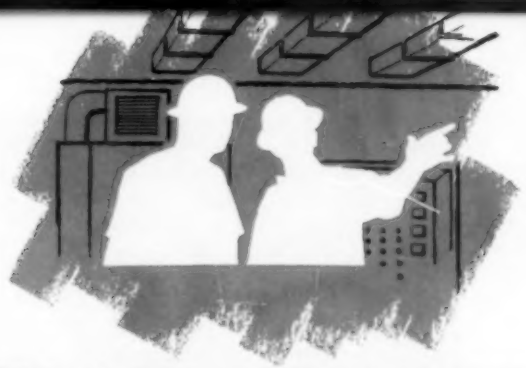


Fig. 6, right. Schematic drawing of closed cooling system. Note basic flow of cooling water, to and from outside reflecting pond.



DESIGN AND CONSTRUCTION OF A "CLEAN ROOM" FROM WAREHOUSE SPACE

By **D. C. BELL**, Supervisor, Plant Services, and **R. J. NEWMAN**, Manager, Plant Engineering; both of Remington Rand Univac, St. Paul, Minn.

ASSIGNMENT: design and construct a "clean room" for assembly of computer parts; use existing warehouse space; stay within a limited budget. This was a project handed to the plant engineering department when our company began the manufacture of a computer for missile control.

To begin, we reviewed the engineering specifications for the room, which read in part:

Temperature, 77 F ± 3 F
Relative humidity, less than 50 per cent
Positive pressure
Allowable dust count not to exceed 60,000 particles per cu ft, with size range from 1 to 5 microns, and 0.1 per cent of this total not over 5 microns

We felt that we could satisfy the environmental specifications with our currently-used construction methods, but were not satisfied with their cost, flexibility and reusability. Our usual wall construction had been of movable section type, ceilings had been both mill type and lighted ceilings, which we thought could be improved. Other areas of improvement included power distribution, bench design and color dynamics.

The warehouse which we were to convert had a 20-ft ceiling, with columns spaced to form 20 ft by 40 ft bays. It had been used for parts storage, so minimum facilities had been provided. Fortunately, all basic utilities such as power, steam and compressed air were available in the general area, and could be used to service the clean room, with a minimum of piping, duct and wire runs.

Our partition construction consisted of 4 ft by 10 ft prefabricated modular panels, which fit our selected ceiling height of 10 ft. The panels were made of 2 x 4 cores, faced with quarter-inch hardboard. Finish painting was done with semi-gloss enamel. To facilitate construction, the hardboard was ordered in 4 ft by 10 ft panels. All

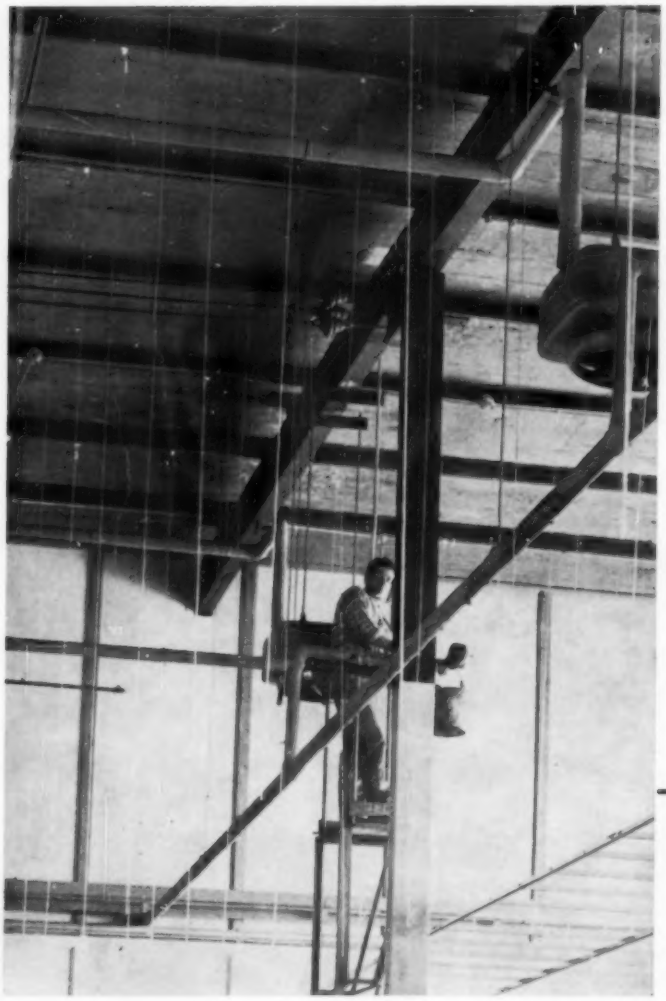


Fig. 1. Hanging wires from warehouse roof joists was first step to convert high-bay space into dust-free room.

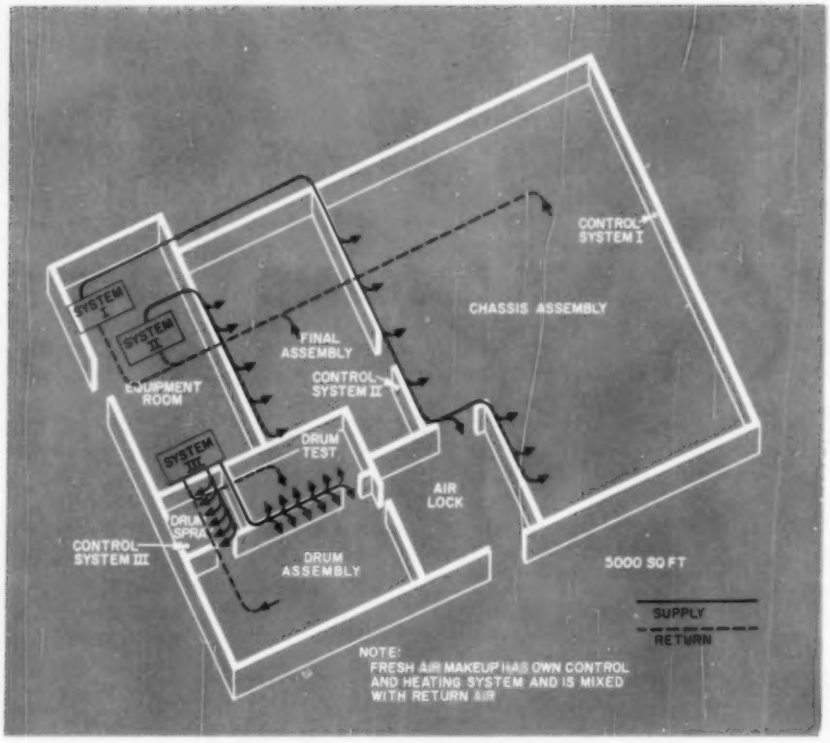


Fig. 2. Isometric drawing of clean room areas show schematic of air circulation systems—each is equipped with its individual cooling unit.

CLEAN ROOM . . .

perimeter and internal partitioning was set up using modular design, and vinyl asbestos tile was used as floor covering in all areas.

As shown in Fig. 2, the main assembly area is separated from some special purpose cleaning and spraying operations that might contaminate the gear being assembled. The assembly areas themselves are entered by passing through an airlock, in which an interlocking device prevents main aisle doors and clean room doors being open at the same time.

Ceiling construction was designed to eliminate standard wood joist and sheeting construction. We elected to drop the ceiling to the 10-ft height by suspending T-bar grids on wires attached to the bar joists above. See Fig. 3. The wires and grids were sized to support the ceiling panels, the lights and some miscellaneous power distribution.

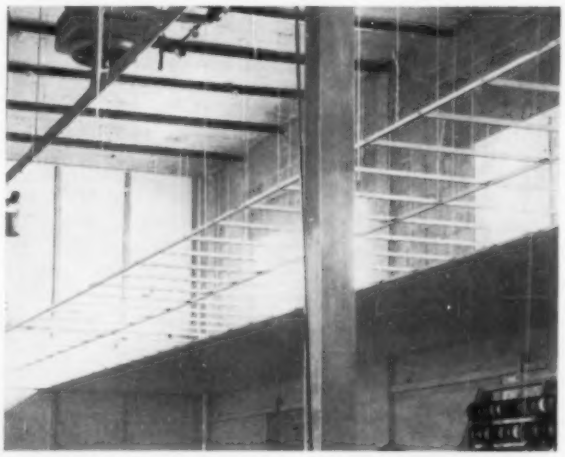
This support system was installed after all sheet metal air duct, electrical distribution lines, sprinklers and other basic utility installations were completed.

Ceiling panels used were of ¼-in.-thick matted glass fiber, measuring two feet by four feet, and finished on one side. Before installation, a coat of enamel was applied to reduce collection of dust, aid in cleaning and reduce flaking of glass particles from the panels. In some areas where environmental controls were more rigid, a vapor barrier backing was added to the panels. In the airlocks and other pressurized areas, it was found practical to utilize holddown clips to keep the panels in place in the grid.

Use of this type of ceiling requires installation of sprinkler protection below the dropped ceiling. To assure a clean installation, only the sprinkler heads protrude through the ceiling panels—all piping is concealed.

Lighting, too, was installed before the ceiling panels were laid in place. The system was designed to maintain lighting at an 80 to 90 foot-candle level. The fixtures are surface mounted, in continuous rows on five-foot centers, as shown in Fig. 4. Polycrystalline plastic lens on the fixtures provide uniform lighting, and the fixtures themselves are relatively free of dust ledges that contribute to

Fig. 3. Grid of T-bar sections, suspended from joists, drops ceiling to 10-ft height. Ceiling panels are laid in grid.



early lighting level reduction. Fixtures are readily accessible for maintenance—which is scheduled to minimize interruptions to production operations. Group relamping is planned, to maintain optimum lighting levels in the room.

Primary power distribution lines were installed outside the room, and necessary openings cut into the walls to admit leads. Power was carried to the assembly benches through metal ducts, shown in Fig. 5.

As shown in Fig. 2, the equipment room is adjacent, but not connected to, the clean rooms. All air conditioning equipment, air filters, water tower, storage deck, motor generator set and miscellaneous electrical panels are located in this area.

The air supplied to the rooms is conditioned by three 15-ton air conditioners and is controlled at 77 F ± 2. The humidity is maintained below 50 per cent. The condenser cooling water is supplied by a water tower and the water is also used for reheat cycle. The tower water temperature is controlled by a solenoid and bypass arrangement to insure proper water temperature for the reheat coils.

The conditioned air is filtered by an electrostatic precipitator and standard disposable filters. Pre-filtered fresh makeup air is added for ventilation replacement of process exhaust and to insure positive pressure in the rooms. Figure 2 shows a schematic of the air handling system supplying the clean room areas.

Clean Rooms Must Be Kept Clean

Constructing the clean room properly is important, but it is also important to keep the room clean. The cleaning portion of the "Clean Room" specifications prepared by Engineering was a result of a joint study by the engineering project, plant engineering, and a janitorial representative.

The easiest way to keep a clean room clean is to avoid contamination, and it is generally recognized that people entering the area are the greatest source of contamination. Better than acceptable results have been obtained by the use of air lock, white coats and rubber finger type floor mats for cleaning dust from shoes.

Fig. 4. Completed assembly room is light, airy and clean. Vertical lines in walls indicate width of modular panels.

The clean areas are equipped with vacuum outlets from a central station exhaust system. The vacuum is used for work station cleaning as well as general area housekeeping. The janitorial services are maintained on a continuous basis during the production work shift.

One man is assigned full time to keep all clean areas in this plant under control. The scheduled cleaning includes:

A. Daily
   1. Vacuum floors.
   2. Wet mop floors every Tuesday and Thursday.
   3. Dust equipment, storage cabinets, shelves drawers and window ledges.
   4. Wash floor mats.

B. Weekly
   1. Vacuum conduit, pipes, outlet boxes and tops of cabinets every Friday night.
   2. Wash doors every Friday night.

C. Monthly
   1. Floors scrubbed and waxed every third Friday of month.
   2. Windows washed every third Thursday of month.

D. Walls and ceilings cleaned, based on routine inspections.

The maintenance of the facility equipment is included in our normal preventive maintenance system. The electrostatic filters have automatic washing systems and are cleaned once a week. The fiber glass filters are changed on a scheduled basis. Maintenance of all facility equipment is made easier by having one central equipment room outside the clean areas.

The construction methods and materials that our plant engineering department selected permitted us to complete our assignment—providing a clean room at a low initial cost. **End**

Fig. 5. Electric power is supplied to benches through vertical metal duct tied to overhead line.

PLYWOOD IN PLANT CONSTRUCTION

By T. O. McCARTHY,
Douglas Fir Plywood Association

STANDARD 4x8-ft fir plywood panels, which for years have been about as familiar and handy in industrial plants as good carpenter's tools, are turning up in new forms these days in plants throughout the country.

Plant engineers have long been aware that plywood has hundreds of miscellaneous plant uses, ranging from easily-built interior partitions to bulletin boards; many are finding that plywood has a far more significant role in industrial construction as an engineered structural material. In fact, at least one plant—International Paper Company at Auburndale, Florida—is all-plywood construction. The plywood beam 'skeleton' of this building is shown in Fig. 2.

Fig. 1. Fir plywood sheathing, supported by box beams built of plywood, forms roof for warehouse. Clips (left foreground) stiffen the panel edges.

Part of the growing use of plywood as a basic structural material in industry lies in the development of standard, engineered components which make it possible to build quickly and economically with big parts instead of little pieces.

Component building is, in a sense, as old as the plywood panel itself—the panel might be considered a primitive component. Realization of the possibilities of components came during World War II with the development of the first box beam—which is basically two plywood skins glued over the top and bottom lumber chords to form a lightweight but extremely strong beam.

Since the war, the plywood industry has developed a component family including stressed skin panels (a plywood "sandwich" which develops great strength using two plywood "slices" glued to lumber framing); Trofdek, the newest component family member which serves as flooring, roofing and as concrete form; folded plates, which have been used both for roofs and floor supports; Insta-Floor, a combination of extremely thick, stiff plywood panels over box beams; and vaulted roofs.

Plumb Doors and Millwork of Richmond, Ill., reports a savings of 30 to 50 per cent over the cost of conventional construction in its new 5000-sq ft warehouse. Fir plywood box beams and plywood roof decking were used. Each beam has four 2x4s laminated as flanges with webs of ½-in. plywood glued and nailed. Stiffeners (2x4x11) are placed on two-foot centers the length of the beams, which are 24 in. deep with a one-inch center crown.

Erection of beams took eight men one afternoon, with enough time left over to put on half of the roof sheathing. The wall framing is of 2x6 studs on 16-in. centers, with 2x6 spiked to the top of the 10-ft high studs. Beams are on 4-ft centers with studs at the point of support (every third stud) consisting of three 2x6. See Fig. 1.

The saving for the job includes both labor and material economies in the roof, and according to the owner, savings ran at least 80 per cent in material alone by using Plyclips (a fastener developed by Douglas Fir

Fig. 3, right. Folded plate roof of plywood stressed skin panels is laid on plywood box beams of the structure shown in Fig. 2.

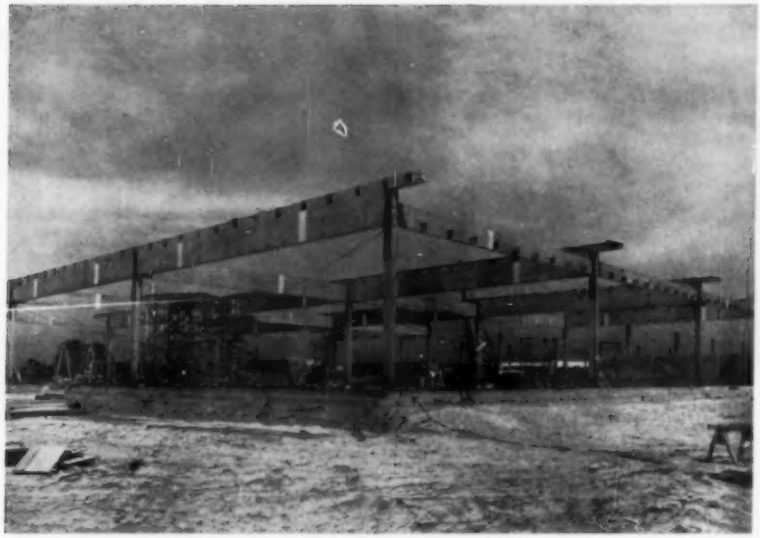


Fig. 2. Plywood box girders form structural framework of all-plywood building. Girders, four feet deep, span 48-ft spacing between columns.

Fig. 4. Continuous plywood panel, in stress, is top chord of bowstring-plywood truss, also serves as roof deck.

Plywood Association) over the cost of conventional tongue and groove roof decking.

The building is 50 ft wide, 103 ft long and 14 ft high. Well over 10,000 sq ft of fir plywood went into the warehouse, including 5408 sq ft for roof sheathing and 5000 sq ft for beam fabrication.

Plants across the country have used a variety of plywood components in combination with others in the component family or alone, but with a single instance, it is possible to indicate the potential of plywood and components in industry. That is the International Paper Company plant mentioned earlier.

It is one of the largest wood structures built since World War II, and its efficiency and aesthetic appeal display many of the technical developments in wood construction since the war years.

The ultra-modern Florida building was built at a cost of $7.54 per square foot. It took 10 working days to erect structural members for the 50,890 sq ft building; 10 days to add roof panels and 5 days to put on plywood siding for the 32x148-ft manufacturing area. Total working time, including offsite component fabrication, was 154 days.

Designed by International Paper's own engineers, components were fabricated at the company's Long-Bell division in Longview, Washington.

Webs of the forty-eight-foot box beam girders used in the building were made by joining 24-ft scarfed plywood panels one inch thick and four feet wide. Horizontal and vertical spacers along the girder length are 2x12 lumber.

Exterior walls of the building are of ¾-in. high-density fir plywood panels, with plastic film bonded on both sides to form exterior and interior surfaces. The clear plastic face allows the wood grain to show through and is expected to be maintenance-free for the life of the building.

The roof is a folded plate design similar to the basic design for folded plates engineered by DFPA. Figure 3 shows the roof during construction.

Office interior wood partitions are sandwich panels with corrugated cores. Various decorative hardwood plywoods are plastic film bonded.

Below windows in the employee lunchroom are special panels of honeycomb core cells bonded to sheets of translucent fiberglass-rein-

Fig. 5. Storage building of laminated timber framework is roofed with ¾-in. tongue and groove plywood sheets.

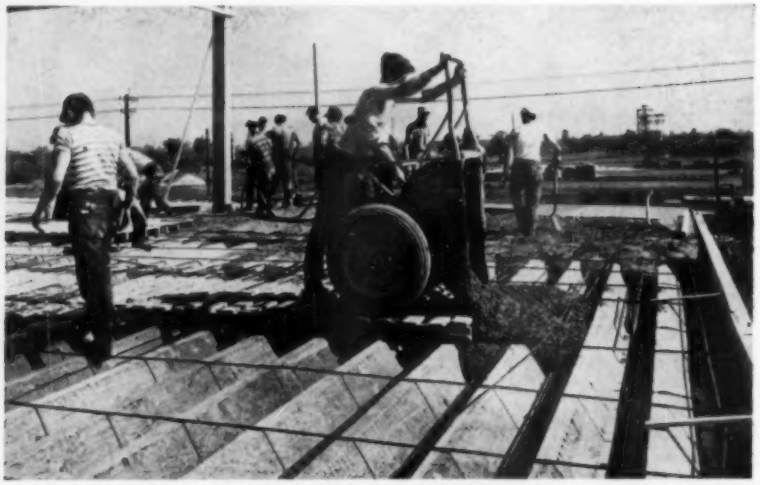


Fig. 6. Trofdek plywood forms as used with reinforcing bars to pour concrete roof. They can also be used as floor supports, as a roof, or vertical wall.

forced plastic. Areas of these panels were dyed to form a colorful geometric design.

While components are growing in importance, so is the standard fir plywood panel. It is a roof deck, a new partition, a sheathing for walls, a load-bearing member or a new layer of flooring.

It has solved many special warehousing problems—in Tracy, California, for example, plywood forms an A-frame warehouse 140 ft wide by 180 ft long and 73 ft from floor to peak, in which is stored pulp from the Holly Sugar Corporation operations. The low-cost structure, designed to conform to the shape of a stack of pulp, cost $3.50 per sq ft, with fir plywood panels over glue laminated beams; additions will run about $3.00 per sq ft.

Plywood I-Beams

To supply a large, economical storage building and do it fast, early in 1954 engineers for North American Aviation, Inc., Columbus, Ohio, "cranked out" a plan for a fir plywood warehouse. Designed around fir plywood I-beams, the building was to be 99 ft, 6 in. long, 44 ft wide and sloping in height from 16 ft, 9 in. to 16 ft, 1½ in.

Twelve days after the first drawing was done, the building was erected and ready for use. It cost around $3.00 per square foot. The structure, it was hoped, would stand up for two years, at the end of which time it would no longer be needed for storage.

However, the building is in use today—six years later. When it was no longer needed for storage, plant engineers took another look at it. No maintenance had been required. There had been no faults—despite the fact that both interior and exterior plywood of mixed grades was used. Engineers decided to keep the building and it was dismantled and moved to a new location where it serves as a combination work room and storage area for maintenance crews.

The building is simple in structure; the long side walls are of ⅜ in. plywood sheathing over posts spaced 4 ft on center. One long wall has posts of two lengths of 2x8-in. lumber; the other has 8x8-in. wood columns. Along the top of the posts an 8x10-in. beam is fastened to the posts with steel plates. Twenty-five fir plywood I-beams are anchored to these two rows of posts, with the beams spanning the 44-ft width of the building. End walls are conventional 2x4-in. studs, 24 in. on center, with ⅜-in. fir plywood sheathing. Vertical battens seal joints of the 4x8-in. plywood panels.

The roof is ¾-in. fir plywood covered with 2-ply roll roofing. The I-beams have ½-in. fir plywood webs 2 ft 6 in. deep. Top flanges of the beams are two lengths of 2x4s and bottom flanges are two 2x6s. Each beam has flanges braced at the center with splice plates bolted to the flanges. Splice plates are 3 ft, 6 in. long with the top members 2x4s and the bottom, 2x6s. Stiffeners are of both 2x6s and 2x4s. All wood-to-wood contact surfaces are glue-nailed. Figure 7 illustrates the construction details of the beams and ceiling panels.

Fig. 7. Plywood I-beams, fabricated of ½-in. plywood webbing and lumber flanges, span 44-ft-wide building.

A typical example of new miscellaneous uses for fir plywood in industry is a combination fir plywood tank with fiberglass-reinforced plastic liner, which costs less than a third as much as stainless steel pickle vats.

Another plywood "entry," Trofdek, which has been used for long spans in more than 500 structures in Canada and England, has been introduced to the United States by DFPA. It is expected to find wide use as an industrial component. **End**

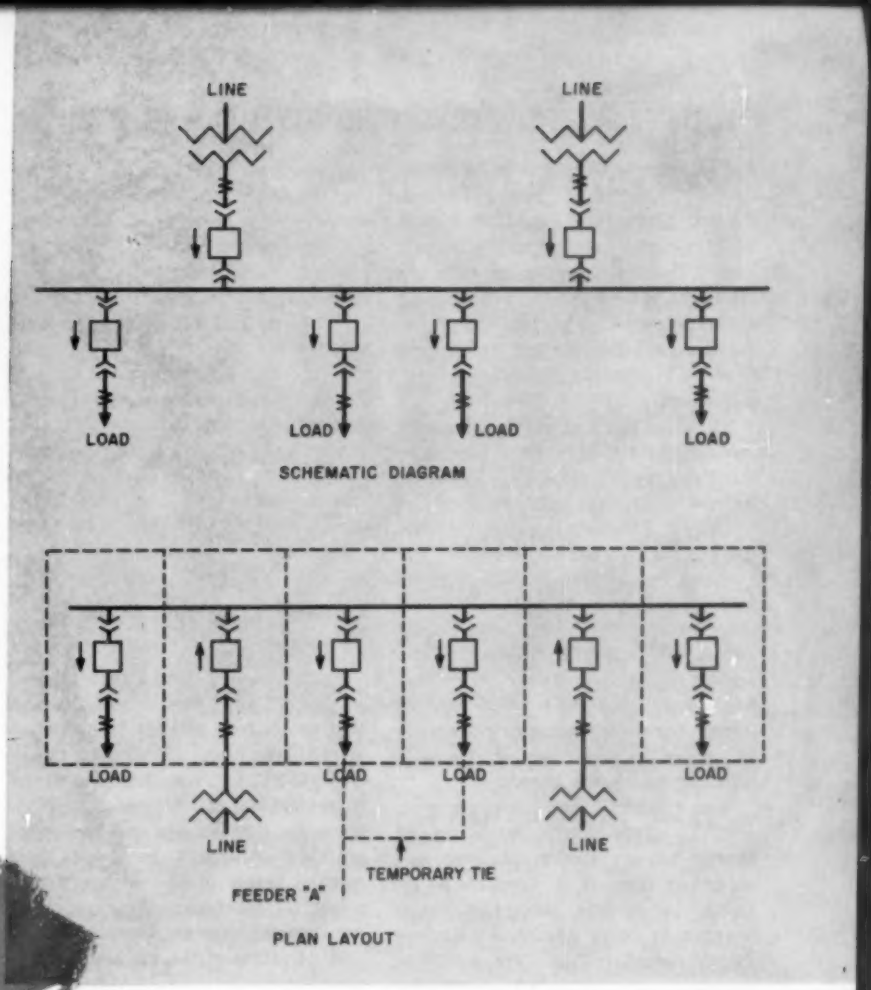


Fig. 1. Conventional circuit layout with two incoming lines and four feeders to plant loads.

INDUSTRIAL POWER DISTRIBUTION DESIGNED FOR CONTINUOUS SERVICE

By **F. M. NOLAN**, Switchgear Department, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONSIDERING circuits which can be used to feed industrial plants, a conventional circuit arrangement, Fig. 1, could have one, two or more incoming lines. For sake of comparison with other circuits which will be discussed later, the conventional or radial circuit shown has two incoming lines and four feeder circuits. In actual practice more or fewer incoming lines and more or fewer feeders could be used.

A typical installation consists of six circuit breaker units and possibly one or two auxiliary compartments. There are many such switchgear groups in use throughout the country, but they have one major limitation;

if continuity of service is to be maintained while any feeder circuit breaker is removed for inspection or maintenance, some temporary tie outside of the switchgear must be made between the feeder concerned and one of the others. In Fig. 1 this tie is indicated by the dotted line for the condition of removal of the circuit breaker for feeder "A".

Some utilities and industrials make provisions for such external ties when ordering switchgear. For instance, the outgoing lines from each feeder might be through potheads with down feed, and the provision for the external tie leads made to the various feeders from roof bushings. Such an arrangement involves additional cost; also the actual tying together of the feeders must be made under "hot-line" conditions. With this type of circuit the preservation of continuity of service to any given load entails difficulty and some hazard.

The transfer bus arrangement, Fig. 3, offers ready continuity of service to any feeder, or from any incoming line, if a breaker is removed for periodic inspection, maintenance or other reason. To remove circuit breaker "A", for instance, disconnect switch "a" is closed. Then the transfer circuit breaker "E" is closed, energizing the transfer bus. Finally breaker "A" is tripped and removed. For breaker replacement, the cycle is reversed.

This versatile arrangement permits continuity of service but is somewhat more expensive than the conventional circuit arrangement. This is because one transfer breaker unit, one transfer bus, and six disconnect switches are used, in addition to the two incoming lines and four feeder units which were selected to illustrate the basic circuits.

Transfer Bus Installations

Transfer bus arrangements can readily be built into outdoor metal-clad switchgear without the addition of auxiliary units. For indoor metal-clad switchgear, the arrangement requires additional superstructures to house the transfer bus and disconnect switches. Although in some cases over-all height of the feeder cubicles might be increased, the floor space requirements are not increased.

A variation of the main and transfer bus arrangement is shown in Fig. 4. This is the double bus installation and is obviously more expensive than the main and transfer bus setup. The double bus has an advantage in that it permits the removal of several circuit breakers at one time without the danger of overloading a transfer breaker and thus limiting the number of circuit breakers which might be withdrawn for maintenance or other purpose.

Some installations of this type are bought with one breaker for each circuit and a spare breaker which may be inserted into empty breaker compartments in order to permit the removal of the breaker on the opposite bus. Where constant power service is a "must", this economic alternate cannot be exercised and all breaker compartments must be filled.

A typical ring bus arrangement using four feeder and two incoming line circuit breakers is shown in Fig. 6. With this arrangement, if it is necessary to remove any feeder circuit breaker or incoming line circuit breaker, continuity of service to any feeder load or service from any incoming line is unimpaired. For instance, the removal of either breaker

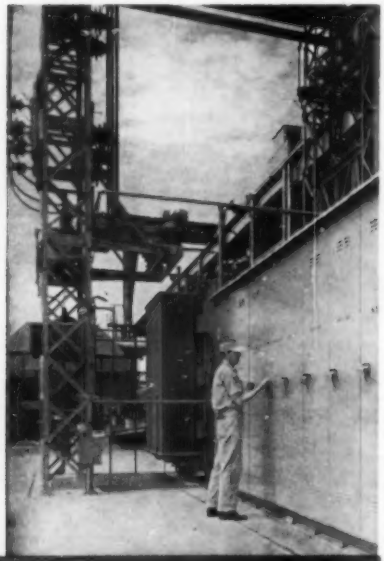


Fig. 2. Typical 4160 volt outdoor substation with protected switchgear.

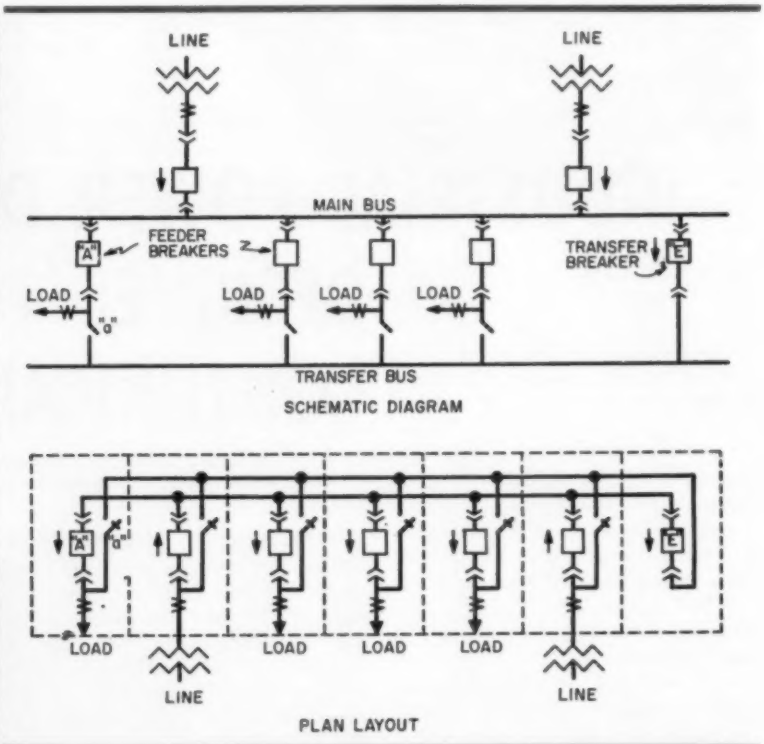


Fig. 3. Transfer bus arrangement offers ready continuity of service to loads.

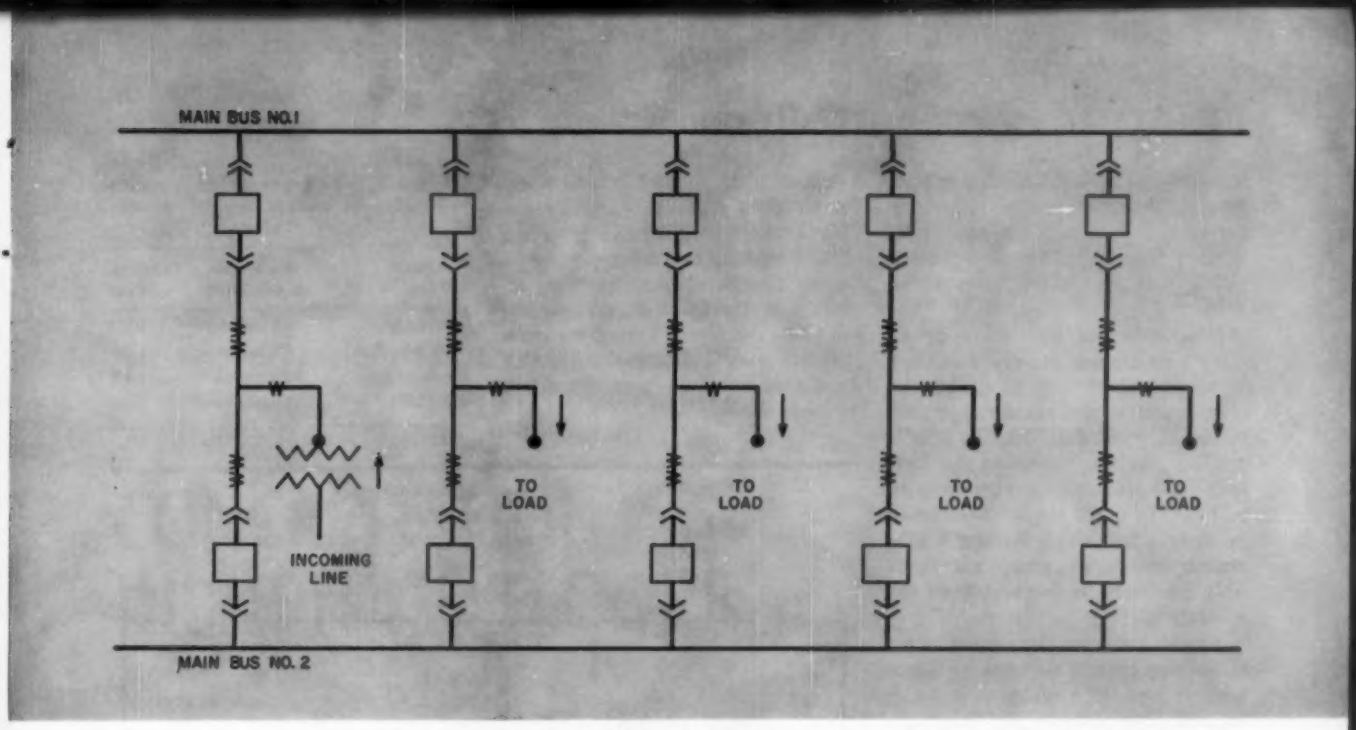


Fig. 4. Double bus installation is more expensive than transfer bus. It permits removal of several circuit breakers without overloading transfer breaker.

5 or 6 will not interrupt feed to load "C", and removal of either breaker 4 or 5 will not interrupt service from transformer "E".

The ring circuit is subject to ready expansion by addition of feeders, incoming lines and consequent reconnection of points "A" or "B". The economic advantage of the ring bus arrangement over the transfer bus arrangement is that no transfer breakers or disconnect switches are necessary.

It is obvious that the ring bus arrangement is less expensive and requires less floor space than the transfer bus setup. The connection "A" to "B" which completes the ring, may be made by bus work internal or external to the switchgear or by cable work outside the switchgear. The diagonal buses, for example "F-G", which must be provided, constitute an increase in cost. However, this addition does not exceed the cost of the transfer breaker unit and the disconnect switches necessary to the transfer bus arrangement.

Cost of the ring bus circuit, while less than that of the transfer bus circuit, is obviously more expensive than the conventional circuit arrangement. It does offer the advantage of continuity of service which in many instances will more than offset any economic difference. The tie completing the ring "A"-"B" can be done in superstructures above the switchgear without necessitating any addition of auxiliary compartments or any increase in floor space requirements.

In the ring bus arrangement is a circuit which improves power continuity by providing each feeder with two sources, using a ratio of one circuit breaker per circuit. Of course, any circuit breaker can be removed

Fig. 5. Overhead bus duct ties two substations together on secondary.

from its unit without disrupting continuity of service. In plants where momentary interruptions are undesirable, the ring may be operated closed and the transformers paralleled.

Elimination of bus ducts or tie cables, which are usually necessary in arrangements such as double duplex, multiplex and similar type substations, is another feature of the ring bus. This arrangement also permits three-transformer substations to be built. In other words, there could be three transformers feeding a substation switchgear group with possibly six loads feeding out from the substation.

Where two- or three-transformer closed ring circuits are used, all transformers feed the switchgear in parallel and thus increase the interrupting requirements of the circuit breakers. For this reason, such closed ring applications are usually limited to installations where continuous power to the load is imperative.

For comparison purposes, a ratio of two feeder breakers per incoming line breaker was used. This ratio gives a strong advantage to the ring bus scheme. A similar favorable ratio would also be attained by using three incoming lines and six feeders. This would require special attention to the short circuit requirements of all the circuit breakers in the closed ring scheme.

The ring bus, double bus and transfer bus arrangements under proper use and proper installation, will maintain service to a given load at all times. They do have disadvantages inherent in them, such as cost and breaker interrupting capacity.

The ring bus can have a further disadvantage in that if the continuous currents are high, all the circuit breakers may have to be rated 2000 amperes continuous. Another limitation is that the ideal application is a ratio of one incoming line to two outgoing feeders. Table 1 compares these various circuits as to cost and availability of power.

There are, of course, other answers to the problem of continuity of power. Much could be written of the statistics relating to possible failures on cables, potheads and transformers. The dependability of these components has been constantly increased.

Choice of the proper type of transformer does much to eliminate circuit troubles while the problems associated with overvoltages may influence consideration of lightning arrestors on circuits subjected to severe switching surges. Transient overvoltages may indicate that neutral grounding of the system should be studied. **End**

Comparing relative cost of circuits and probable availability of power.

Circuit Type	Probable Availability	Relative Cost
Conventional	95 per cent	1.00
Transfer Bus	98 per cent	1.30
Double Bus	100 per cent	1.80
Ring Bus	100 per cent	1.20

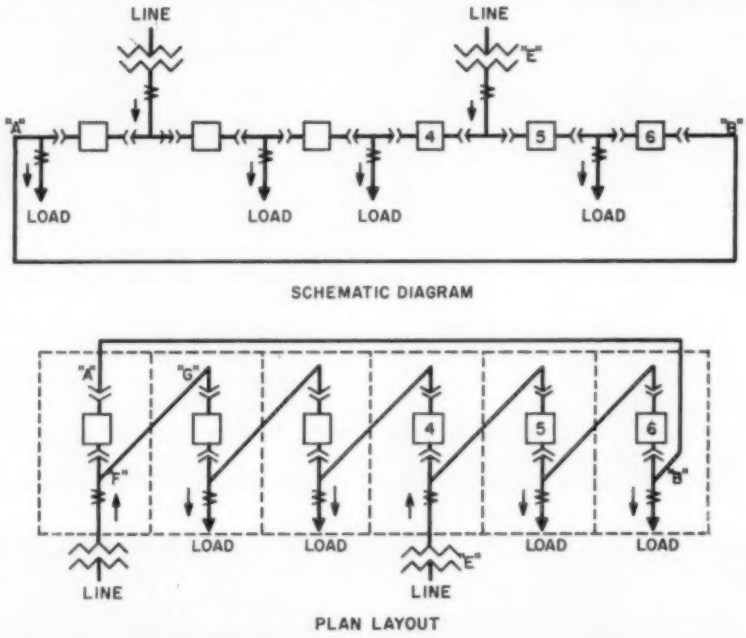
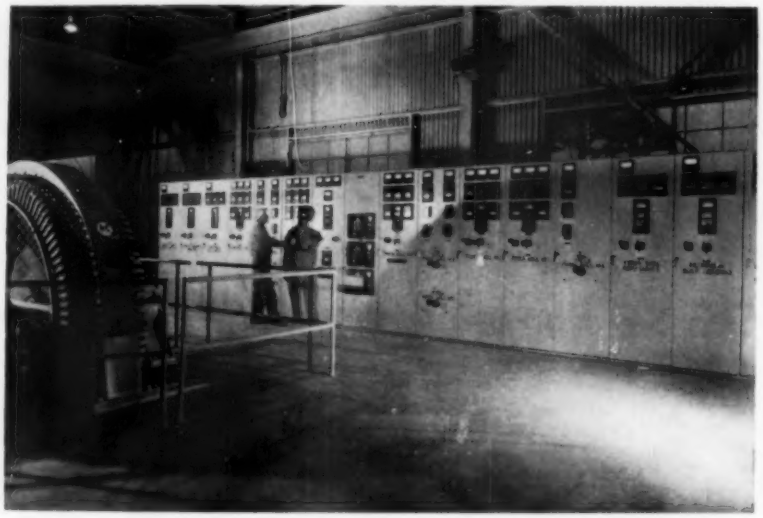
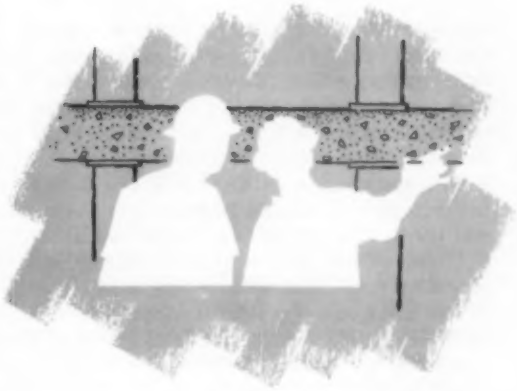


Fig. 6. Ring bus arrangement permits removal of any feeder circuit breaker or incoming line circuit breaker without impairing continuity of service.

Fig. 7. Indoor installation of 5 kv switchgear and motor control. Distribution center contains 16 units rated with an interrupting capacity of 250 mva.





Concrete technology has made tremendous strides, yet concrete is still being poured with a seeming neglect of basic principles that eventually leads to total replacement

CONCRETE FOR INDUSTRY'S FLOORS

By **LEO LIBERTHSON**, Technical Director,
Building Products Div., Sonneborn Chemical and Refining Corp.

IN DESIGNING a concrete floor, the first consideration, naturally, is the mix itself. A satisfactory concrete floor is obtained by careful selection of materials and mix proportions, good compaction and finishing procedures, and adequate curing. The concrete should contain not less than 5 sacks of Portland cement per cubic yard and a minimum amount of water that will allow proper placement. The water content should not exceed 6 gallons per sack of cement. Probably the most common fault in concrete work is the use of more water than is required to get good workability. The aggregate should be sound and well graded. A mix commonly recommended includes 1 part Portland cement, 2¼ parts fine aggregate graded up to 1½ in., and 3 parts coarse aggregate graded from ½ in. to 1 in. Proportions are by volume.

The grading of the aggregate has an important effect on the final concrete product. The shape of the particles and range of dimension determine the void content of the aggregate; this in turn influences the amount of water required to produce adequate workability. A well-graded aggregate will leave a minimum of voids and thus will require a minimum of water and a minimum of cement to fill the voids and bind the aggregate together.

Aggregates with high water requirements necessarily require more Portland cement to produce a given strength.

A concrete floor finish must be hard, dense and smooth. The concrete should be consolidated by vibration or by thorough spading and tamping, after which it is screeded to grade. The concrete is vibrated and screeded immediately after placement; a vibrating screed that compacts and levels the concrete in one operation is commonly used.

Screeding is immediately followed by floating and darbying. The darby is a specially-constructed long float. Its has a three-fold purpose:

1. To embed coarse aggregate in preparation for hand floating and troweling.
2. To level the surface and eliminate straight-edge or screed marks.
3. To achieve additional compaction of the surface.

Mechanical floats permit the use of a much stiffer mixture than can be used when floating is accomplished by hand, and shorten the total time required for finishing.

Troweling is an extremely important operation and one which requires experience and skill for the best results. It should be done at the proper time—after the concrete has hardened sufficiently to prevent drawing moisture and

Fig. 1. Pouring a concrete floor slab involves more than the physical placement; careful mixing is mandatory.

CONCRETE FOR INDUSTRY'S FLOORS

fine materials to the surface. Cement or mixtures of sand and cement should not be spread on the surface to absorb excess water; rather, the mixing water should be kept to a minimum and troweling delayed until the bleeding water disappears back into the concrete. Final troweling should be done after the concrete is so hard that no mortar accumulates on the trowel and a ringing sound is produced as the trowel is drawn over the surface. This will polish the surface to a smooth finish.

Curing of the concrete is tremendously important, as this has a large effect on the strength and impermeability of the final product. Floors that are to be covered (e.g., with tile) should be kept moist a minimum of three days; floors that are to be exposed require a minimum of five days curing. These periods are required during warm weather; if the ambient temperatures are around 40 F. or below, these periods should be doubled.

Points on Curing Concrete

There is enough water in a good concrete mix to allow adequate hydration of the cement, provided the water is retained in the concrete. Curing can be accomplished by covering the floor slab with wet burlap as soon as this can be done without causing damage to the floor. Moisture-proof paper, polyethylene, or liquid membrane materials may be used to prevent loss of water from the surface of the concrete, and adequately seal the surface against water loss. This is an acceptable method of curing concrete, but some of these compounds may tend to interfere with bonding of other materials and must be removed before a satisfactory resilient floor installation can be made.

Concrete floors that are "soft" or have a tendency to "dust" are invariably the result of improper finishing procedure and lack of curing. Such floors eventually require sealing with penetrating resin solutions.

The problem of moisture with certain floor coverings is more common for concrete on grade and below grade than for floors in other locations. Although manufacturers have developed products that are resistant to the effect of moisture, there are a number of resilient floor coverings which are not recommended for use in areas subject to dampness. The following sources of water must be considered:

Water in the concrete mix: One source of moisture is from the water initially contained in the concrete, and as far as the concrete is concerned it is desirable that the water be retained until initial maximum design strength is achieved. On the contrary, the installer of resilient floor covering desires that the concrete slab be relatively dry. The obvious solution is to cure the concrete for the minimum time that will produce a satisfactory floor and then allow it to dry.

The use of as little water as possible in the initial mix will reduce the amount of water that must be removed from the slab prior to installation of finish flooring. In this respect, the use of air entrainment allows some reduction in water content and, in the amounts normally used, causes little reduction in strength if cement content is maintained.

The use of lightweight aggregate concrete for floors has become more prevalent during the last few years. This is due to the fact that such concrete weighs about two-thirds as much as conventional concrete and, in multi-story construction, this is translated into reduced dead load that may allow savings in construction costs. But most lightweight aggregates, because of large internal surface, have higher water absorption than normal weight aggregates and, as many of them are crushed materials, lightweight concretes always have a higher gross water requirement than regular concrete. The lightweight concrete, therefore, dries more slowly than regular concrete. With resilient floor coverings that are sensitive to moisture, a longer drying period should be allowed.

Moisture migration through the slab: A second source of moisture is from the soil beneath the slab. Soil experts agree that the relative humidity directly beneath the slab will generally be 100 per cent. A concrete slab exposed to high humidity on one side and to low humidity on the other will transmit moisture from the high humidity to the low humidity side under constant temperature conditions. The concrete slab is generally a few degrees warmer than the soil, but even so the vapor pressure is greater beneath the slab than over it, except under usually humid conditions during the summer, so that moisture will generally tend to migrate up through the floor. However, the quantity of water transmitted through the slab depends to a large extent upon the quality of the concrete in the slab.

Good quality concrete is highly resistant to moisture migration. With proper proportions of cement, water and aggregate, and with good consolidation and adequate curing, the hydration process tends to fill all the capillary voids.

The permeability of Portland cement paste with water-

Fig. 2. Important step, floating. This early working of the concrete surface can have great effect on slab life.

Fig. 3. Two jobs concrete floors must take in stride—the live storage of assembly parts as well as routine aisle traffic.

Fig. 4. Pallet storage adds another hazard to the concrete floor slab; the abrasive action of sliding pallets.

cement ratios less than 0.50 by weight is comparable to that of dense limestone and quartz rock. During the hydration process, the individual cement particles produce an amount of gel about twice their original volume and, in high quality cement paste, essentially all of the capillaries become filled with the products of hydration so that moisture migration takes place through the gel pores. These pores are very small and provide a very tortuous path for the movement of moisture. This accounts for the relative impermeability of neat cement, i.e., hardened cement paste.

Undue dilution of the cement paste with excess water provides spaces that cannot be filled by hydration products. These spaces then are open channels for the passage of water, and their volume is directly proportional to the quantity of excess water. Accumulation of air and water in pockets under the larger pieces of aggregate also provides channels that bypass the more impermeable cement gel and aggregate.

It may be that a concrete floor is laid directly on grade or, where a building has one or more sub-levels, below grade. In such cases, the underside of such floors may come in direct contact with water. Since all concrete possesses a moisture permeability factor, sensible floor design must rely on the use of vapor barriers for absolute exclusion of moisture. Only where the geological factors make it certain that moisture barriers are unnecessary, is it possible to exclude these as a design necessity. In such cases, a concrete designed for greatest impermeability may be regarded as a probable assurance against entrance of moisture from below. This assurance may be even further extended by inclusion of densifying admixtures, but, again, only if such admixtures permit significant reduction in mixing water, i.e., in water-cement ratio.

While the usefulness of admixtures in producing better and more impermeable concrete is universally admitted, where concrete floors are laid on grade, their exclusive use can seldom be relied on to produce a slab which will function as a *complete* water barrier. A recent project to validate this point indicated that where concrete slabs on ground are designed, admixtures alone cannot be expected to exclude moisture. Membrane barriers between ground and slab are mandatory.

Assuming a concrete floor has been laid and the finishers had just completed their work (brought the surface to a smooth, trowel finish) traditionally, the next step is to cure the concrete. Again, traditionally, this has meant keeping the floor wet.

Curing a concrete floor has a specific technical meaning. It is to control the rate of evaporation of the water used to mix the components so that the Portland cement phase is completely transformed. In chemical terms, this means that the Portland cement must hydrate—re-combine with the water of which it was at one time deprived—because only then will the concrete achieve maximum design strength. The conventionally used methods for curing include covering with sand, hay, paper, burlap or similar materials in the web. All these manifestly keep the water in the wet slab from evaporating under conditions of extreme temperature and humidity. All of these covers may in turn be kept wet by hosing.

Modern practice is to use liquid membrane curing compounds applied by spraying them onto the freshly laid concrete at acceptable and established rates of coverage. Among the first to be used were simply asphalt emulsions. These, however, being black, were objectionable, even though they did check evaporation rates, because black surfaces absorb heat. They were rapidly supplanted by clear, almost transparent compounds, usually solutions of waxes in common petroleum solvents. In turn, waxes gave way to resins which gave more continuous films. Finally, white pigments were incorporated to reflect heat, and still further help retention of water by the concrete. It is a rare large-scale concrete project on which one or another membrane curing compound is not specified. **End**

A NEW PREFAB OF PAPER HONEYCOMB

This modular building system, designed for transportability and reusability, incorporates a lightweight building panel . . . aluminum-faced paper honeycomb

By **N. A. LOMBARD**, Administrator, Aircomb Section, Douglas Aircraft Company, Inc., Santa Monica, Calif.

IN SIX WORKING HOURS, two all-weather, fast-assembly buildings of unique design have been erected at the White Sands Missile Range, New Mexico. These prefabricated buildings were designed, engineered and fabricated by Douglas Aircraft Company, Inc.

The secret of speedy assembly (and military specifications airborne or ground mobility) is the use of aluminum-faced building panels assembled into roof-wall modules. The sandwich panels are arranged in a series of identical bays or modules, custom made to meet individual requirements.

Core of each panel is a lightweight, high strength structural paper honeycomb, Aircomb. Impregnated with phenolic resin for strength and resistance to environmental factors, the expanded structure is made to guaranteed tolerances of ±0.010 in. normally, and to closer tolerances on order.

It is extremely rigid; a one-inch-thick panel, which weighs ¾ lb per square foot when faced with 0.016 aluminum, has a rigidity factor of 792,000. Such a structure is 1/16 the weight of steel of the same rigidity; 1/10 the weight of aluminum and 1/5 the weight of birch plywood of equal rigidity.

A two-inch panel, faced with 0.020 aluminum, has a thermal U value of .210. The panels have above-average resistance to rodents and termites and can be treated to be completely resistant if necessary. They are resistant to attack by fungi under tropical conditions, and complete protection may be added.

The uniform panels for the White Sands buildings have mortised edges in which are fitted pneumatic tubes. Inflated to approximately four pounds pressure after the modules are erected, the tubes fill all apertures between panels, insulating against heat, cold, moisture and dust. The buildings are equipped with standby compressors, to maintain this pressure in case of leaks or other loss of air.

Each module consists of ten parts; two wall panels, two roof panels, and six truss components. Erection is simple; it is done module by module. Two wall panels are placed on the ground or other level surface. (Fig. 1.) Two roof trusses, sheathed with roof panels, are lowered over the wall

Fig. 1. First step in assembly of module is laying wall panels in place—here, on a portable steel foundation.

Fig. 2. After truss members are attached at hinge points, roof panels bolt to truss and wall panel sub-assembly.

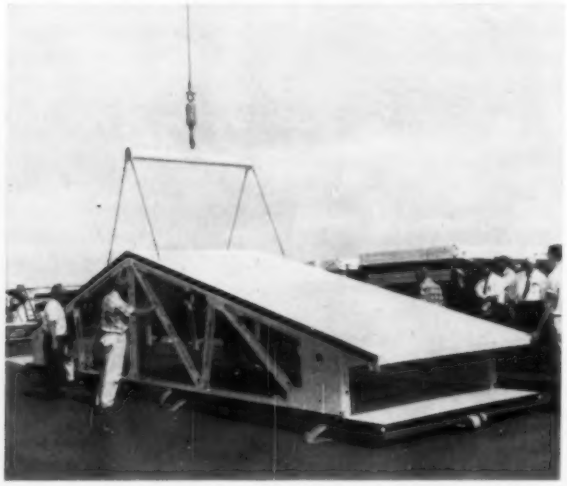


Fig. 5. One of two completed buildings at White Sands. End panels are pre-assembled, with air-sealed joints.

panels and attached to them at the hinge points just below the eaves. (Fig. 2.)

A crane then lifts the roof at the ridge of the gable, the walls unfold into their vertical position and the complete module is rigidly secured by a few bolts. (Fig. 4.) This assembly process is repeated for each modular unit and when the final unit is secured, erection is complete.

Electrical wiring and air lines are pre-installed in the trusses. By plugging in these systems as the modules are erected, the services become available as the building progresses.

Single-story buildings can use wall panels up to 20 ft high (maximum panels are 10 by 20 ft). A maximum economical span is 50 ft, without intermediate columns. Two-story buildings are possible, but beyond that the economics would have to be developed.

The building system is ideal for simple shell construction, yet it offers complete prefabrication that includes power, light, air, etc.—services that permit occupation as the building is erected.

The buildings generally have excellent design criteria for environmental conditions such as high wind loads (up to 150 mph) very heavy snowloads (up to 50 pounds per square foot) and very broad range of temperatures (−65 F to +200 F). Requirements for very unusual or specific cutouts (doors, window, emergency outlets) are engineered into the design and present no problems to the erector at the building site. The buildings are resistant to attack by fungi under tropical conditions, and complete protection may be added.

The Aircomb building system has a lot to offer general industry but should not be built as a do-it-yourself project. Each job must be specifically engineered, using certain basic design factors and adapting them to individual needs.

The building is not for small single room buildings or garage type construction. Such small industrial units would not benefit by the engineered approach. Existing standardized methods of construction would undoubtedly be more economical.

In units of a minimum of 1000 sq ft, however, the engineered building offers a bigger value for the dollar; the larger the square footage involved, the more attractive it becomes.

There is no limitation on maximum size. This becomes increasingly important when erection time, maintenance and higher over-all utilization of strengths is considered. Furthermore, the buildings may be erected in isolated areas where skilled building construction help is scarce or impossible to get. And, the buildings may be demounted (from a concrete slab or a steel "footing" that can be shipped with the panels) and moved away to be used again.

The building modules can be transported by truck or airplane anywhere and unskilled labor, with a single motorized crane can place the building in operation in a matter of hours. If necessary, the building can be erected without a crane. **End**

Fig. 3. As crane lifts roof truss, wall panels unfold to vertical position, and module is secured by a few bolts.

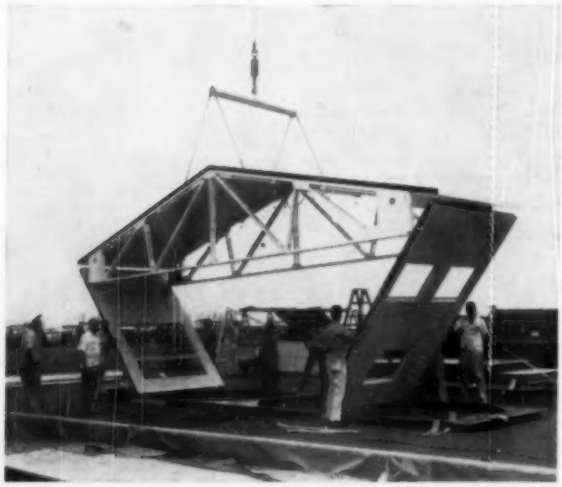
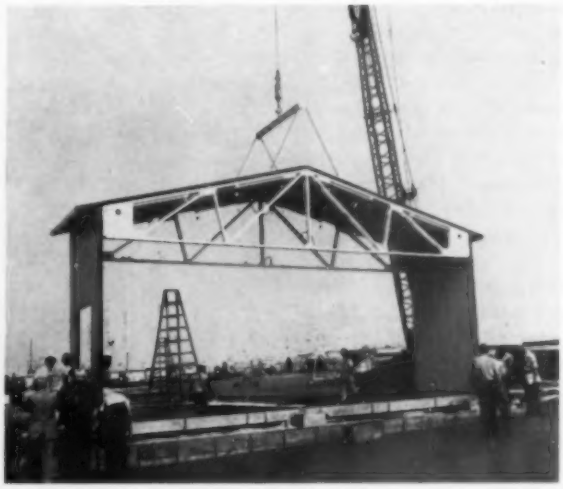


Fig. 4. With module bolted down, next unit can be added. Power and air lines are plugged in, air seal is inflated.



FIRE PROTECTION WITH PIPED DRY CHEMICALS

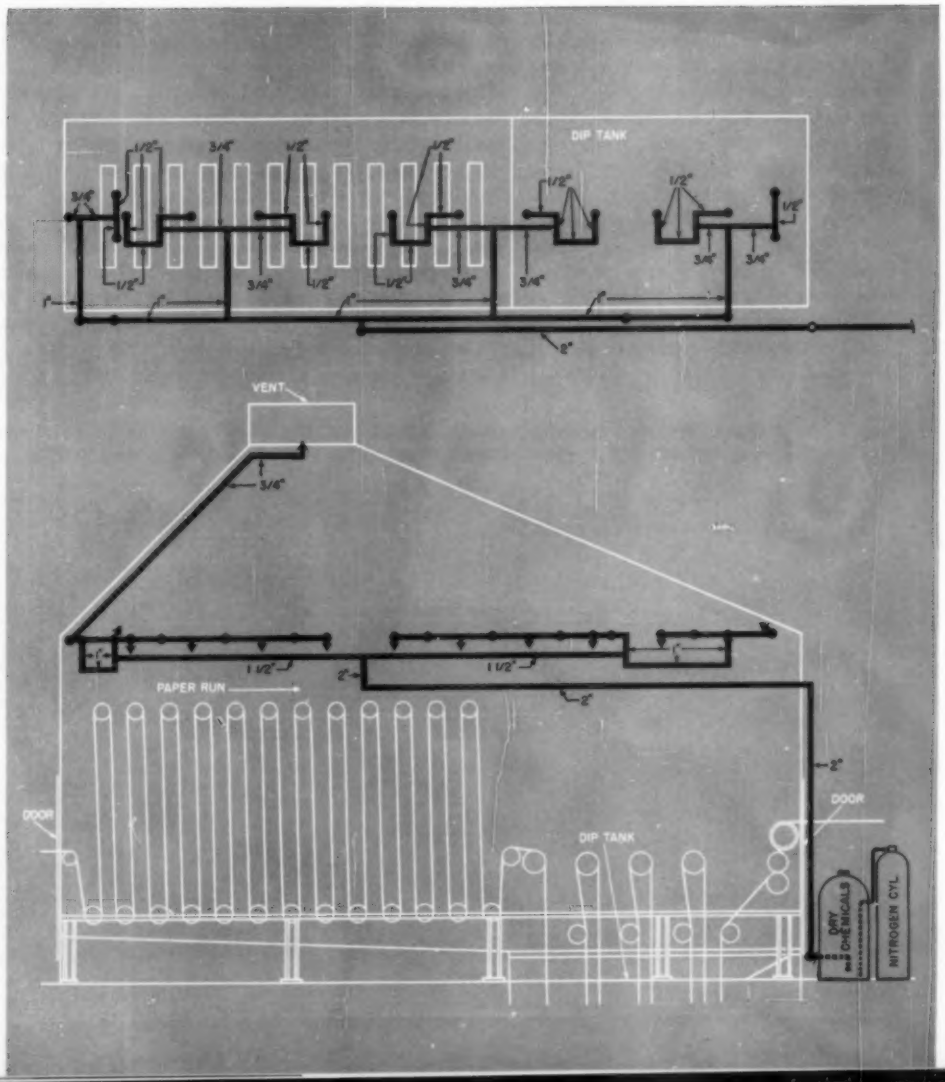


Fig. 1. Piping diagram of dry chemical system installed to protect an asphalt saturator hood.

Fig. 2. Cabinet holds a 300-lb capacity dry chemical unit. Spare nitrogen tank, spare chemical fit inside.

By **GEORGE A. BRELIE**, Manager,
Special Equipment Department
Design and Development Division
Ansul Chemical Co., Marinette, Wis.

AN IMPORTANT phase of the contruction planning for a new plant is the consideration of the fire protection that is to be provided for the structure and the production machinery it will house.

One of the newest types of automatic fire protection is the dry chemical piped system, which conveys a dry chemical compound to the scene of the fire through pipes. The system is designed to provide coverage evenly over the entire hazard area for a long enough period of time to assure extinguishment.

Dry chemical piped systems are particularly adaptable to such hazards as paint spray booths, oil quench tanks, petroleum pumping stations, electric transformer vaults, electric generator bearings, flammable liquid storage rooms, and similar hazards. Although they are ideal for the protection of practically any hazard involving Class B material (flammable liquids) these systems are not recommended for hazards involving fine electronic equipment or locations which require dust free atmosphere.

The dry chemical piped system was developed by Ansul in 1600 flow and fire tests; because none of the rules already established for the flow of liquids and gases were applicable, a step by step procedure was necessary to work out the rules for design.

Although it tended to behave something like a fluid under pressure, dry chemical was found to have distinct flow characteristics of its own. Pipe sizes and configuration in design were found to be very important in layout of any system in order to achieve the proper distribution of dry chemical to a hazard source. A 100 per cent safety factor has been incorporated in the design of the dry chemical piped systems.

Chemical Flows Under Pressure

Control of chemical begins at the dry chemical storage tank, which remains unpressurized until an inert gas (nitrogen) is introduced to "fluidize" the dry chemical and pressurize the tank. The pressure is allowed to build up by use of a special bursting disc which is located in the main supply line beyond the tank. When the tank pressure reaches 165 psi, the disc ruptures and dry chemical flows at high velocity through the piping.

Calculation and design of the system are important because each length of pipe, as well as each elbow and tee, produces a definite pressure drop which must be considered in deriving a minimum rate of flow for any system. The rate of flow in a system can be varied to fit the need by changing the size of the nozzles or piping.

Because of dry chemical's fire-killing ability, the equipment for a dry chemical piped system usually requires a minimum amount of floor space. Dry chemical consists basically of sodium bicarbonate (common baking soda) especially compounded with other chemicals to maintain free flowing and moisture repellent characteristics. It is non-toxic and completely safe for personnel involved in its use. The piped systems can be recharged by simple procedures, immediately after use.

The actuation of a dry chemical piped system can be accomplished in any one of three ways—manually, pneumatically or electrically.

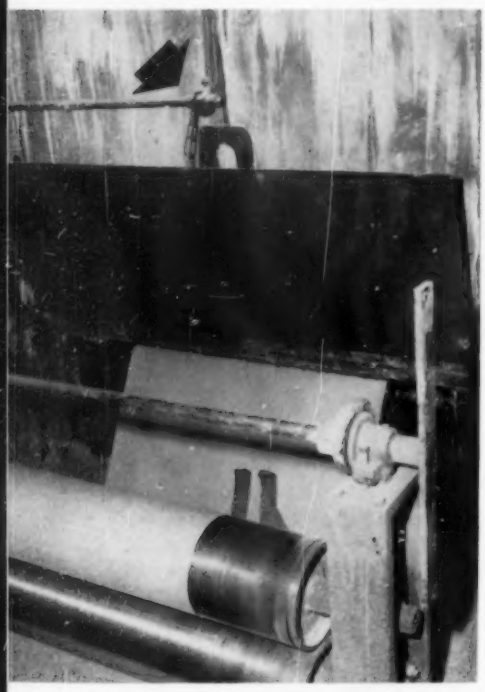
The manual release is used where automatic actuation is not required or where it is preferable to have the operator actuate the unit because of special conditions.

The pneumatic release is actuated by a pressure impulse received as a direct result of a sudden rate of temperature rise at the hazard. It may also be actuated manually or by means of a cable or pneumatic remote pull station.

The electric release is actuated as a coil is energized when a switch or thermostat in the fire area is closed.

There are two principal types of detectors used. The H.A.D. (Heat Actuating Device) is a pneumatic sensing device consisting of a hollow brass chamber and tubing connected

Fig. 3. Tripping mechanism (arrow) drops door when extinguisher is triggered. Nitrogen pressure operates trip.



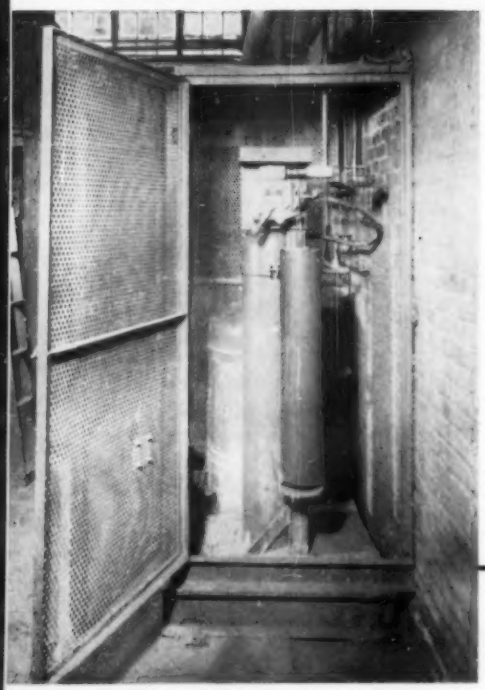


Fig. 4. Installation of unit in asphalt saturator area. Minimum floor area is required for gas, chemical storage.

to a pneumatic release. It is installed in positions most likely to be affected by the heat of any fire which may occur. A rapid rate of temperature rise increases the pressure within the chamber, actuating the release.

The electric detector is a simple electric switch which closes when heat is applied. The action is caused by the use of a bi-metallic element or by the differential of expansion of two separate metal contacts. When the switch makes contact it closes the electric circuit to the release. Usually, systems so actuated require a secondary source of supply, either battery power or a source from outside the hazard area.

Pressure trips, which are automatically operated by pressure from the system, can be used to close fire doors, windows, ventilation ducts, etc. A pressure switch is used to shut off motors and fans, sound alarms and transmit signals to fire alarm headquarters. These pressure trips are also actuated by nitrogen pressure and go into action the instant the nitrogen cylinder is opened.

Ideal for Asphalt Saturators

Dry chemical piped system protection is well suited to such hazards as asphalt saturators. The experience of one plant in the east provides an interesting case study.

This plant became especially aware of the fire problem in these saturators through the loss of an entire building in the late 1940's.

In the saturation process, rolls of raw paper felt are fed through a series of loops, then through several hot asphalt spray and dipping operations until they leave the saturator to be finished into roof shingles.

The asphalt is normally heated to a temperature of roughly 450 F to keep it in a fluid state and permit better impregnation of the felt. If, for some reason the asphalt becomes overheated and the temperature rises considerably above the 450 F mark, a fire can result.

Another frequent source of ignition is the presence of foreign particles in the rolls of felt. These particles sometimes cause sparking which ignites the vapors from the heated asphalt, quickly involving entire saturator.

There is no question that fire extinguishment methods such as water spray and foam, will extinguish such fires. However, a cleanup problem can be encountered as the asphalt usually boils over under pressure of the steam generated from water or foam used in the fire extinguishment. Anti-foaming agents sometimes are employed, but their use is not positive assurance against boilover. As a result, the cleanup time required before the resumption of operations, and damage to the stock in the area often represents more dollar loss than the actual fire damage.

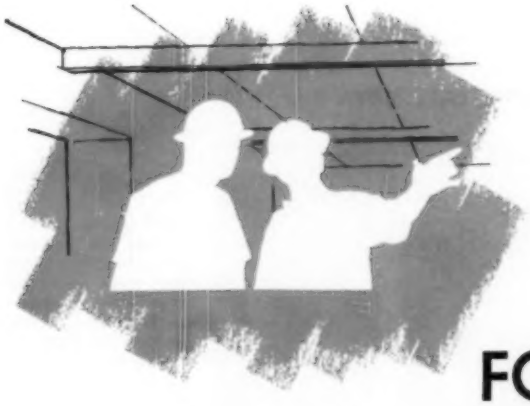
Since asphalt saturation is basically a dirty job, it was determined that good preventive maintenance and effective automatic fire protection probably would be the best answers for keeping down fire losses in the saturators. Then, in 1955, Ansul helped design an automatic dry chemical piped system to protect an asphalt saturator.

This unit, with a capacity of 500 pounds of dry chemical, replaced hand and wheeled dry chemical equipment that had been used in the plant for sometime to extinguish saturator fires with excellent results—but relying on the human element.

It was felt that dry chemical piped systems with automatic detection and actuation features would provide quicker knockdown and extinguishment of any fire. It would also permit the resumption of operations with the least possible downtime and stock damage. The first unit performed so successfully that the following year two 300-pound units were installed to protect a tar storage tank. Then, in 1959, another automatic dry chemical system was installed in another saturator, again of 300 pounds capacity.

Reports to date have indicated that the original installation has actuated at least six times without a failure. In some instances, hand equipment was used to extinguish smoldering embers that remained. This, however, was expected since the class "A" material if heavily involved, could create some lingering embers.

Loss of operations due to cleanup after each fire have been reduced from as long as 24 hours to a maximum of two hours, and in one instance, to as little as 45 minutes. The reports also indicate that loss of materials has been negligible. **End**



LIGHTING DESIGN FOR PLANT OFFICES

By **J. L. TUGMAN**, Lamp Division, General Electric Co., Nela Park, Cleveland, Ohio

THE RESIDENT architect for the G-E Lighting Institute at Nela Park, W. D. Riddle, has done a series of critiques* on lighting design. For the benefit of PLANT ENGINEERING readers I have shaped up conversations with Mr. Riddle on how these critiques may be utilized for industrial applications.

Over a period of years Mr. Riddle has chosen problem space in the Institute for a succession of his own personal office solutions. On one occasion he transformed a corridor display window into an outstanding office for himself. More recently he has created a highly personalized professional environment for himself making use of an angled section of windowless passage. Since offices in industry must often be located in space that can be spared from production I asked:

"What service might be made of the design of your present office for plant management?"

Mr. Riddle replied:

"It has been my observation that, as many small plants expand, one of the first consequences is to make existing space produce more. Although supervisory responsibilities multiply, management must sacrifice office area to production. This often results in cramped, inefficient working conditions for responsible people. My present office demonstrates that work space, with privacy and comfort, can be created in an odd-shaped windowless area. With a little paint and some plywood panels the awkwardness of many kinds of space can be converted into usefulness with beauty. New ceilings can be provided simply with the extremely light weight shielding panels such as I have used for my general lighting. Since much industrial lighting today presupposes controlled conditions for production, air conditioning would be presumed available for making such a space conversion practical."

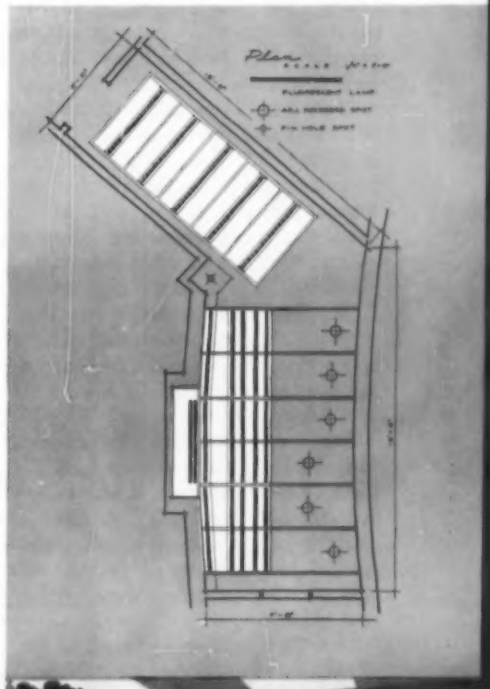
This answer seems to have good reference value for plant engineers

CRITIQUE NO. 1

The Space: a windowless, low-ceilinged corridor with rough plaster and brick piers, the latter flanking an opening on one side of the area.

The Project: to convert this space into an attractive private office suitable for drafting and discussion.

Foot-candle Levels:
Drafting board—150-200 ft-c
Work surfaces—40-80 ft-c
Bookshelves—150 ft-c on lowest shelf



The lighting system in this narrow, windowless office accomplished two objectives—in addition to providing light where it is needed for visual tasks. The first is to make the office area seem larger than it really is. The second is to make people forget they are in a windowless space by relating the lighting to various architectural elements in such a way that the illumination has a natural, daylighting quality about it. Objects are seen in highlight and shadow. The alcove almost assumes the characteristics of a window. Wall textures are emphasized. A three-dimensional effect is created that would have been impossible to achieve with only one type of general illumination or light source. The result is aesthetically satisfying.

*Published in LIGHT—G-E quarterly on lighting practice.

with problems of compressing management quarters without serious complaint. It suggested another challenge as to the relevance for industry of some of his designs for executive offices. So I asked:

"What do you do for the office of the plant manager or the local vice president in charge of operations?"

"In some plants the boss used to use a discarded packing case for a desk and a box for a chair. It set the standard of economy for other supervisory people. Today, such Spartan example is not good practice for plants which have achieved some prestige. The boss can and should have attractive quarters suitable for conferences. They can be tastefully decorated and furnished. Where this is permissible there should be appropriate good lighting to give enhanced appearance as well as to supply restful illumination. For instance, the style of office created for the Institute's manager of Lighting Education is keyed to his function. A production executive could use an office designed with similar features to general advantage. It has freshness, and a charm of a suitably masculine order. One man who occupied it had been a Navy captain in World War II. His successor, a well-known athlete and outdoorsman, finds it suitably virile for his environment, too. Good lighting, of course, sets the tone and preserves the appeal of the space."

Another question addressed to Mr. Riddle, and prompted by the luminous wall areas that he designed into the Lighting Institute restaurant, was this one:

"How would you make use of multihued luminous walls in industry?"

To this question a characteristic Riddle reply:

"Well, industrial plants have cafeterias, often in space without windows, or with windows that open on cheerless blank walls. The idea of the luminous panel is to overcome the closed-in feeling. Luminous wall panels have the effect of extending the space, and, if some color change is possible, this effect can be greatly heightened. I am sure that many ordinary costs of production could return more profits if plant environments were treated to evoke warm responsive feeling with an eye for improving company image with employees. Grim surroundings may emphasize the strictly business-like purpose of the industrial plant. But plants can be business-like and attractive, too. The growing preference for industrial park locations suggests there is a trend for beauty in factories. In any event a lighting feature such as a luminous vertical surface in a cafeteria or a recreation room does not involve a large investment. It could be developed by in-plant personnel."

CRITIQUE NO. 2

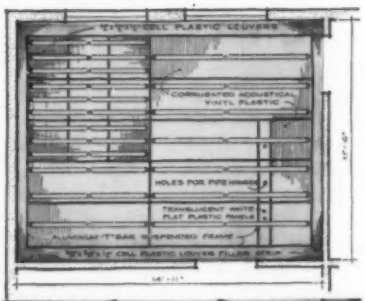
PERSONALIZING A PRIVATE OFFICE

This system operates to meet the requirements of the occupant. When visual tasks are not difficult, the average level of illumination may be about 50 foot-candles—at least 100 ft-c at the desk. This lighting is produced by operating only one circuit in each section. When all four circuits are in operation, the lighting level on the desk is about 400 ft-c.

As an expression of the occupant's personality and interests, the private office is often residential in character. This concept of design tends to overlook an important function of the space, and that is the nature of the work done in it. This work involves lengthy sessions at the desk, reading detailed reports (often in fine print), conducting important conferences during which blueprints and drawings may be presented, and, of course, quiet conversation with only two or three people in the room.

The lighting designer will quickly recognize in these a number of seeing needs calling for a variety of lighting levels and effects.

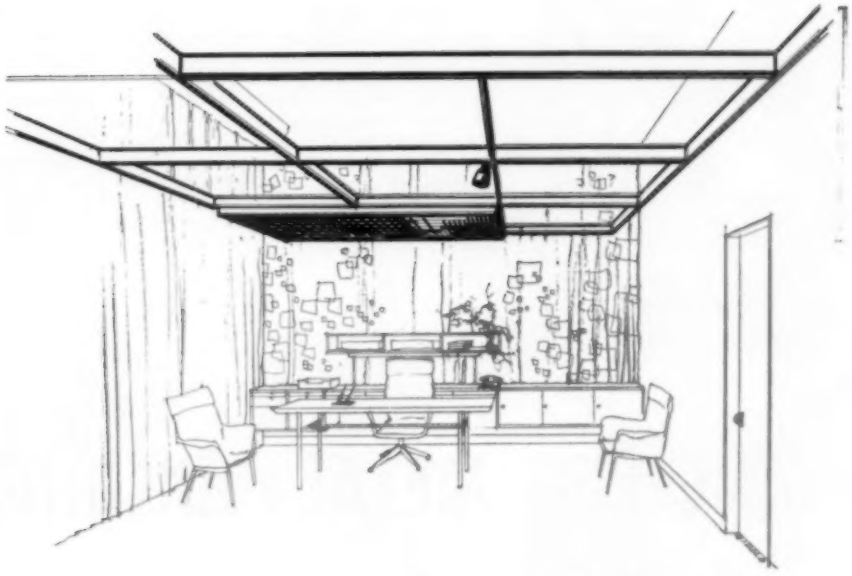
A lighting system that will meet all these requirements—one that is directly controlled by the occupant—might also be considered an extension of his personality. Such a system is described here. In addition to personalizing the room in a unique way, it influences the appearance of the space, making it seem larger or smaller, accenting mementos on the walls and shelves, and bringing brightness into comfortable balance.


CORRUGATED ACOUSTICAL VINYL PLASTIC
HOLES FOR SPRINKLER
TRANSLUCENT WHITE FLAT PLASTIC PANELS
ALUMINUM T-BAR SUSPENDED FRAME

CRITIQUE NO. 4

THE LUMINOUS VERTICAL WALL

A luminous vertical surface creates an illusion of openness. It is for this reason that the completely luminous wall, or even the small luminous element that is little more than decorative, serves a valid purpose.

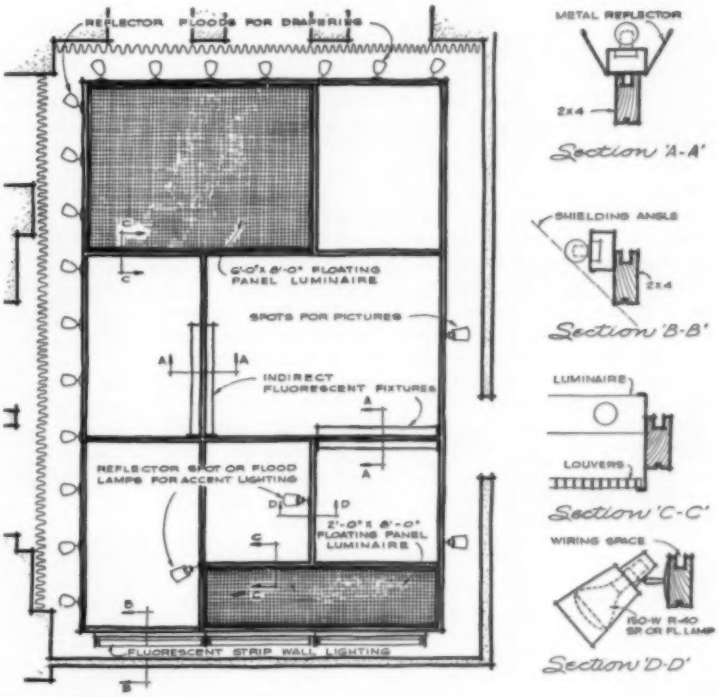


CRITIQUE NO. 3

LIGHTING SYSTEM IN SEARCH OF A SPACE

Usually we have a space, then look for a suitable lighting system. In this case, we decided it was perfectly feasible to design a lighting system that could be adapted easily to almost any space—new or remodeled.

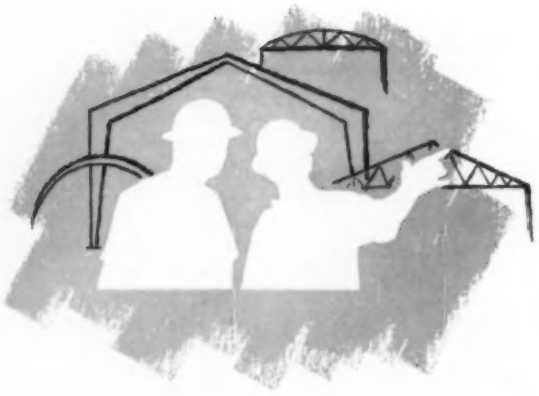
Our objective was to show how unrelated lighting elements could be coordinated to provide the utmost flexibility in system design and lighting levels. The framework, of a comparatively lightweight structural material, is suspended from the ceiling. It incorporates floating panel luminaires, indirect, wall, and accent lighting units. And, it can be modified or circuited in such a way that any number of lighting effects can be achieved.



In window or basement rooms, particularly in the case of a plant cafeteria, the luminous vertical surface adds interest to the wall and helps to bring room brightness into balance, improving visual comfort. It relieves that "closed-in" feeling, and creates a distinctive architectural element.

Flexibility can be achieved through the circuiting and dimming of the lamps, by changing lamp colors, and by mounting an applique on the front or back surface of the diffuser.

Design possibilities are almost unlimited. Only one technique is shown here.



PRE-ENGINEERED METAL BUILDINGS

"What is really being talked about when people refer to pre-engineered metal buildings is a relatively new concept of construction. Ready for occupancy, these buildings necessarily incorporate use of many other types of materials—masonry, brick, aluminum, vinyl tile, plywood paneling, plumbing fixtures and piping, electrical wiring, etc.

"It is generally understood that the over-all building industry remains one of the few frontiers still largely untouched by mass-production methods and techniques. The significance of the concept of pre-engineered metal buildings is the success it has had in reducing the cost of construction—not only from the standpoint of original materials cost, but also from the standpoint of erection cost. A pre-engineered metal building is ready for occupancy in about half the time required for other types of construction, permitting the building purchaser to get his capital investment to work on earnings faster.

"Not too long ago, this type of building was generally identified as a 'tin shed.' This identity was deserved. From the standpoint of appearance, the pre-engineered metal building's potential for serving as manufacturing operations housing was restricted to out-of-the-way places.

"However, recent engineering, manufacturing, design and styling advances have now earned the pre-engineered metal building the right to a 'place on Main Street.' And, of course, the design of the pre-engineered metal building has been a natural companion to the trend of industry to go 'ranch style' for the housing of production operations.

"It permits the building customer to forget about the traditional complexities of industrial building. The engineering has already been done for him, just as it has been done for the automobile buyer. He can forget, too, about unfamiliar labor requirements and complex erection machinery. Pre-engineered metal building components are available today to accomplish almost any design, except multi-story.

"In essence, the concept of pre-engineered metal building construction today represents an important cost-cutting blending of product development, manufacturing, engineering and design techniques to provide good, attractive, economical housing for industrial production activity."

... **CHARLES HOMER**
President, Stran-Steel Division
National Steel Corporation

Fig. 1

Fig. 2

One of several building units at the Riverbrand Rice Co., Houston, Texas, is shown in Fig. 6. Note the use of roof beams in reverse attitude, with resulting flat roof line. These buildings were supplied by the Metallic Building Co., Houston, as were the two buildings in Fig. 7. Attached to conventional production building at Devoe and Raynolds Co. plant in Houston, these metal buildings are both 100 ft wide and 13 ft, 9 in. high, of rigid frame construction. One is 100 ft long, the other 140 ft. A 10-ft-wide canopy, 108 ft long, extends over the loading dock at end of one building.

Fig. 7

Fig. 5

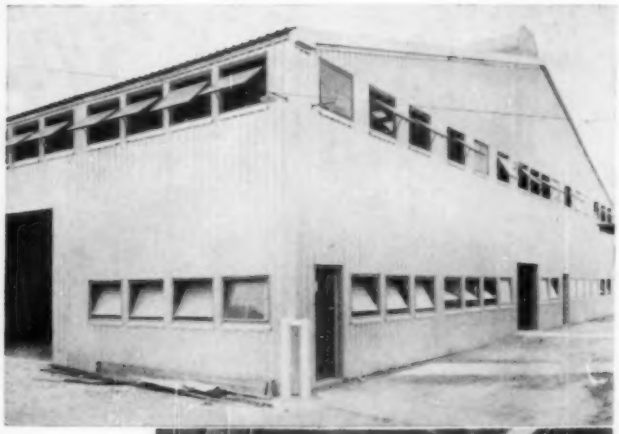


Fig. 4

Fig. 6

Figures 4 and 5, interior and exterior of a pre-engineered metal building furnished by the Parkersburg Rig and Reel Co., to the Mid-Atlantic Glass Co., Ellenboro, W. Va. Designed to house a glassware producing facility, this building was erected over the existing building, with no interruption of production. The building is 100 ft wide, 72 ft long and 20 ft high; it was contracted for, delivered, and erected over the old building in 75 days. Unusual features include the high-level windows and the metal panel divider, shown in Fig. 4, separating kilns from remainder of the plant.

Fig. 3

Three buildings, fabricated by Butler Manufacturing Co., make up the plant and office of the Deutsch Molding Co., Banning, Calif. Two buildings span 100 ft, are 140 ft long and 14 ft high; the third spans 28 ft, is 80 ft long and 12 ft high. The office exterior features stone veneer, a metal panel gable, a pylon and canopy. Butlerib panels form the building walls; insulation is fiberglass blankets. Interior treatment includes a suspended ceiling in one of the larger buildings. Fig. 1, over-all view; Fig. 2, closeup of entry exterior; Fig. 3, finished, lighted interior of production building.

Fig. 8

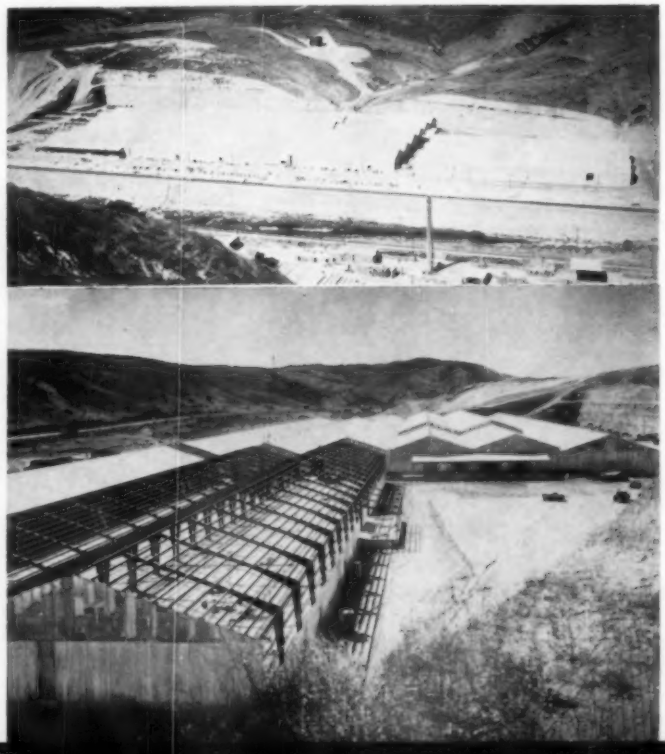
New plant of the E. D. Jones Corp., Dalton, Mass., is made up of nine Armco steel building units. With the exception of the two smallest, all are truss-type buildings, ranging in width from 20 to 100 ft, from 100 ft to 402 ft in length. Clear heights under trusses range from 12 to 40 ft. Pre-engineered buildings permitted construction use of various bay heights, for economy. Plant was erected in 9½ months; it is the largest (200,000 sq ft) industrial facility of steel building construction in New England area.

PRE-ENGINEERED METAL BUILDINGS . . .

Fig. 9
Fig. 10

Evidence that the metal building is not a tin shed—new manufacturing plant of Light & Power Utilities Corp., Olive Branch, Miss. Three 70-ft rigid frame spans, fabricated by Stran-Steel Div., National Steel Corp., are tied together to form 112,000-sq ft building, 14 ft to eaves. Exterior shows blend of canopy, brick, aluminum sash and door, and pre-painted steel panels to beautify entrance. Fig. 10 shows attractive decor of executive office. Building cost, $2.23 per sq ft.

Fig. 11



This 500,000 sq ft giant tops them all—Convair's Material Building, San Diego, Calif., is biggest in the country. Building consists of multiple spans, 80 to 90 ft in width, plus 21,000 sq ft of canopy. Rigid frame structures, fabricated by Soule Steel Co., San Francisco, are covered with high-tensile, deep-corrugated sheets for maximum strength. Special feature of buildings is use of swinging doors to permit fork truck entry.

Fig. 12

THE PLANT ENGINEER IN CONSTRUCTION

AN EVALUATION

By JOHN VONDERHEIDE,
Manager of Plant Engineering,
General Electric Co., Louisville, Ky.

EXPERIENCE as Manager of Plant Engineering for General Electric's Appliance Park in Louisville, Kentucky, enables me to re-examine the construction and operation of this facility, and outline our philosophy as to the role the plant engineering component should rightfully play in the design and construction of facilities. Our large plant site functions as an "industrial community" —each of the product departments operates almost as though it were located on an isolated site.

Plant Engineering

Our plant engineering component, a part of relations and utilities services operation for Appliance Park, works as a "captive" architect-engineering firm, whose existence is justified only by its contribution to the park site "customers." We sell our services on a unit price basis and are always in competition with any other engineering medium which could be used to accomplish the same tasks.

Focusing keen attention on the functional and flexibility aspects of our plant facilities appears to be the only way to be sure that long-range benefits are derived from proper balance of facilities, efficiency, and built-in features which assure high morale of employees and their overall well-being. The productivity of each employee can well depend, to a major extent, on facilities as tools to bring about top motivation.

The day when massive industrial monuments could be justified has long since passed, and every facilities project must be carefully weighed on a balance sheet basis—pointing out the exact contribution the project will make to long-range productivity and the resultant profitability or, even stronger, just how plans will fall short if the project does not proceed.

More specifically, as a result of what we have learned at Appliance Park, I offer the following important considerations.

When our site was selected, it was with the goal of having this large industrial plant be a definite asset to the rural and residential community involved. Sufficient acreage was used to provide for long-range module type layout; landscaping of border areas and similar features which would keep it from creating the old conventional "factory type" atmosphere; adequate facilities for traffic entrance and exit, and automobile parking were all included. The real return on this type capital investment can be measured in three distinct ways: (A) the surrounding community is proud of their new neighbor and thus offers willing support, (B) employees appreciate the pleasant surroundings of their work place and thereby keep morale at the highest, (C) the actual quality of manufactured products is always improved because numerous problems such as air pollution, noise, vibration, etc., are minimized and can be controlled.

Design Criteria

Selection of the design criteria for architectural and structural features of the buildings is deserving of thorough attention—to properly fit the buildings to climate conditions, land utilization, etc., and still provide for maximum long-range flexibility; arrange building structure layouts in such a way that they are compatible for elevation, appearance, easy expansion framing, low cost walls where acceptable, etc.; at the same time, the importance of what might be erroneously termed luxury features such as tinted window glass, well insulated roof sections, resilient floor where beneficial, heavy-duty floor where needed, can all be weighed and "price tagged" to see whether they will really make their contribution. These are points which will prove to be of much value in the control of costs as we encounter ever-changing layout problems in the years ahead.

Good Lighting

Good lighting receives heavy emphasis in any construction or remodeling projects we handle today—in fact, the lighting in the original Appliance Park buildings has become obsolete in only eight years, and we have tried to profit by this realization. We believe that the building shell as designed by the architect-engineer should only be provided with bare minimum lighting, with the exact occupational need dictating locations where 60 to 100 foot-candles, or even higher, would be recognized as satisfactory lighting levels today. We found that much money can be saved by this approach.

Heating, air conditioning, and ventilating is another area too often considered quite routine—we have come to realize that heating, cooling, or ventilating the building, as such, is not what we are after—better localization of installed equipment to provide good temperature in the "worker zone" is the right objective. Who really cares what the conditions

AN EVALUATION . . .

are 20 feet above the working floor, insofar as keeping people comfortable is concerned? We must utilize design and equipment to provide the right conditions in the actual used area and let the balance of the large cube ride without major concern. Again, this plan saves a lot of unnecessary capital investment.

Our facilities design engineers have also found it extremely important to provide for industrial hygiene problems in both basic building design and when working up the process layout—for example, the proper heat shield around furnaces, ovens, etc.; shower facilities for extremely dirty operation spots; highlighting mechanical equipment guards, etc.; setting up what we choose to call a "discomfort index" so that this type of irregularity can be contained within a reasonable range. Careful planning and location of service facilities such as food, dispensaries, toilet groups, etc., are other examples of important features.

Fig. 1. Appliance Park, where the author finds that responsibility for an industrial complex this size focused his sights sharply on his role in construction of new plants.

Renovation Schedule

A well planned renovation schedule to keep all facilities abreast with the progress of available materials, innovations, conveniences, etc., is a part of facilities operation which is often overlooked. We have found that the idea of conventional factory type toilet batteries, for instance, is obsolete. Actual experience has shown that employees place great value on modernization effort, and they assist management by automatically raising the level of housekeeping and general protection of the equipment as a direct result.

Another tremendous dollar-saving potential is in the area of balance between primary type utility services and secondary installations—we have found it to be extremely beneficial to concentrate on most adequate primary distribution and almost eliminate the secondary aspect until the actual usage installations are being made—it is almost as though we were going to plan to move the secondary right along with the process equipment, instead of making it a permanent part of the equipped building.

Plant Services

Segregated industrial waste systems, water management program, proper provision for the handling of cyanides, spent acids, etc., with loop design for underground and overhead mechanical services such as fire protection, gas, steam, etc., would be other examples where careful attention pays a fine dividend.

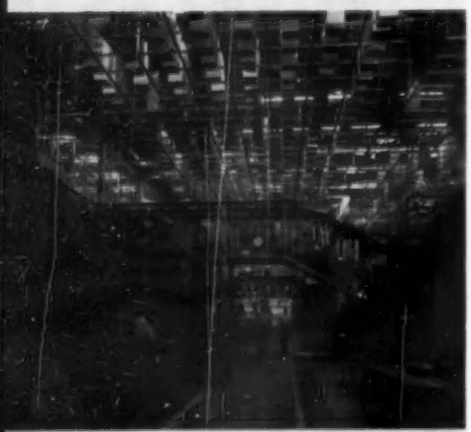


Fig. 2, 3. "Before and after" rearrangement of plant lighting due to a production layout change—one of many plant engineering responsibilities as a service group.

Liaison Function

One most important point—in new facilities or major remodeling of existing facilities where it is beneficial to have outside architect-engineering service, major contractors to do the work, project engineers to supervise the job, etc., they are actually completely helpless in achieving the real purpose without a thorough knowledge of the real usage or purpose of the project. Construction and acceptance for occupancy in the time ahead must be "meshed together" by the plant engineering component, which is the logical liaison between the product department (owner) and construction people. If plant engineering will accept the task of truly performing as agents for their department "customer" who must in the end make good with the facilities provided, there seems to be little doubt that the arrangement is best.

The Right Approach

On the other hand, over past years, there has been evidence that plant engineering sometimes performed as though they were the dictatorial group who knew everything about facilities, and they often failed to grasp the importance of being the "life line" for long-range survival of their particular company.

With the right approach, we have not found any product department which would ever want facilities provided without complete plant engineering participation, because they know that the plan provided is the best insurance that they can get to successful operation in the years ahead, by accurate interpretation of their requirements at the time of initial construction.

Architect-engineers verify the fact that they can do a better and more economical job when the owners' wishes are "channeled" via people who understand both sides of the tremendous industrial facilities design task and can clearly transmit set objectives.

These people are the plant engineers—and this is their important role in industrial construction. **End**

HOW TO DESIGN

PNEUMATIC-HYDRAULIC ACTUATION SYSTEMS

TWELFTH IN A SERIES OF ARTICLES

Part XII. Designing pneumatic-hydraulic systems for moving the workpiece and the tool

IN THE FINAL article of this series we will dwell upon a couple of the more complicated pneumatic systems used for industrial applications. We should, however, first review some of the major points brought up in this series and remember these points when designing or installing a system.

1. Install suitable lubricators and filters. This is the best insurance you can buy. Without these items you can always expect trouble and you will generally get it. Dirt is one of the biggest enemies of a pneumatic system.

2. In adverse atmospheric conditions provide protection for the piston rods of cylinders and extended valve stems. This can be done by providing boots, scrapers or non-corrosive parts or a combination of these.

3. Keep circuit components away from hot blasts by providing some type of shield.

4. Provide suitable mountings for the circuit components. Remember there is usually considerable vibration or shock present. Keep the piston rods aligned.

5. Above all, keep even the most complex systems as simple as possible. Don't overload a system with unnecessary valves or other components.

6. Don't cheat on the diameter of fluid lines. Too often dissatisfaction in the operation of a fluid power system can be attributed to fluid lines which are too small. Valves often malfunction due to fluid line restrictions which cause back-pressure or sluggish operation. Cylinder movements will also be slowed due to restrictions. A good rule to follow is to use lines having the same internal area as the pipe port area of the cylinders in the system. Valves can be sized accordingly.

7. Keep fluid lines as short as possible in order to reduce time lag on fast-acting systems.

8. Use components which are suitable for the job. Too often a cheap installation turns out to be a costly one in operation. Remember downtime and maintenance are costly items.

9. When installing pneumatic equipment in explosive atmospheres, pilot-operated controls can save considerable expense over the use of electric controls. However, in some installations the electric controls are necessary and must be explosion-proof.

10. Analyze your compressor capacity and do not overload it with additional pneumatic systems. Excessive pressure drops often cause malfunctions.

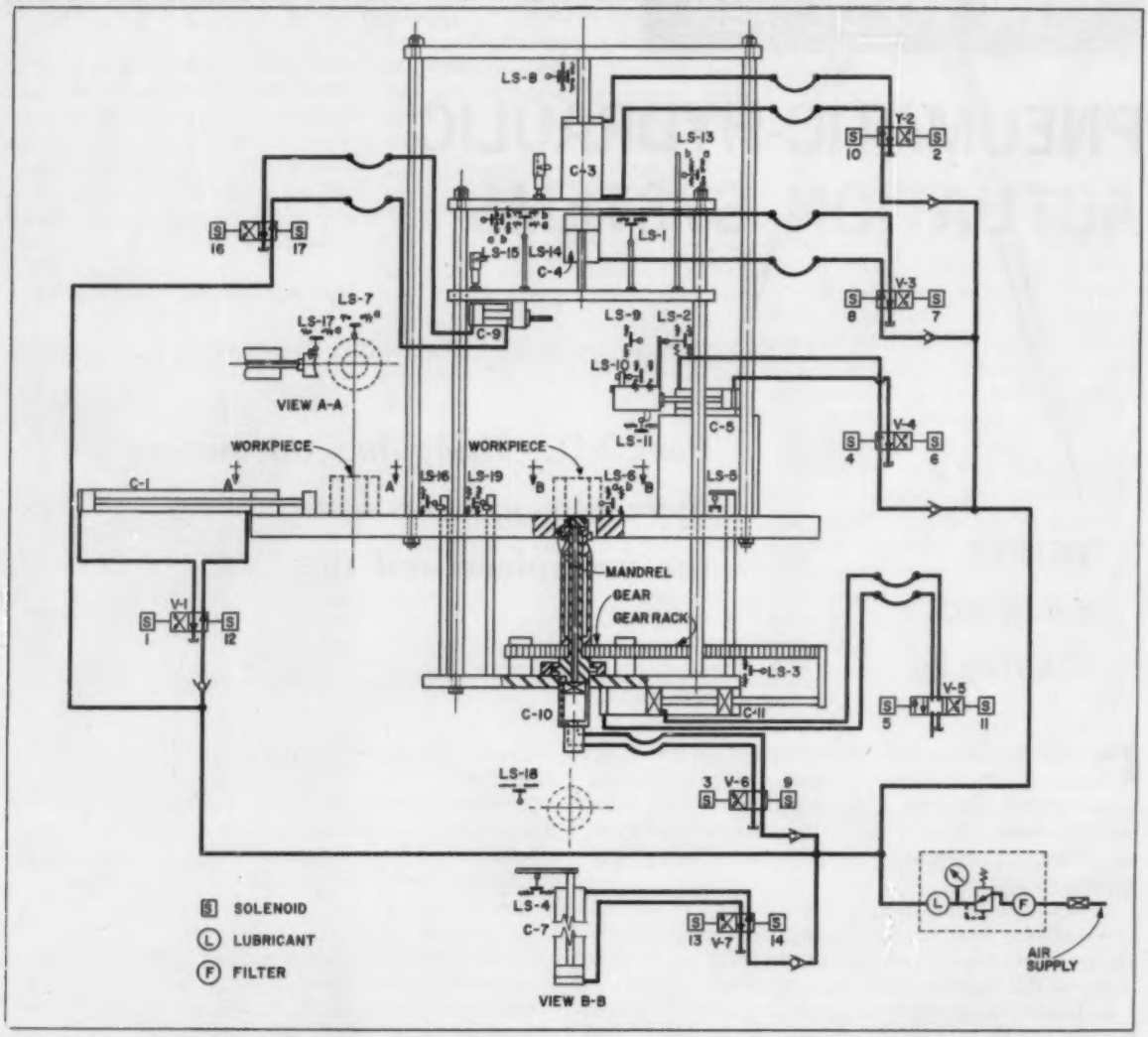
Remember the success of a pneumatic system is only as good as the design and installation.

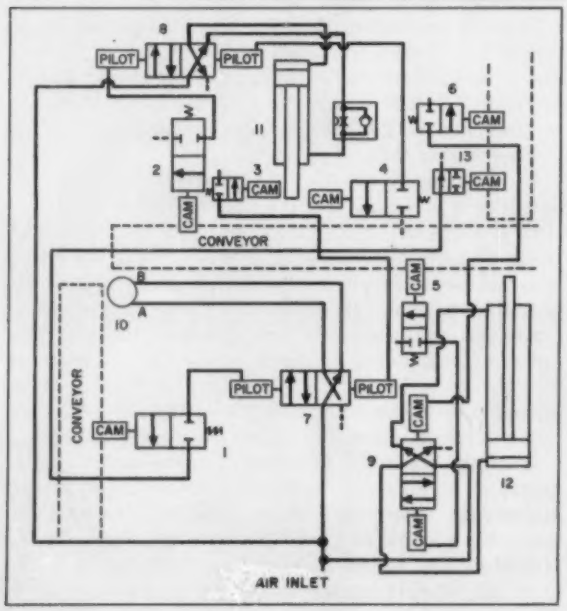
In going into one of the more complex systems let us look at Fig. 1 where we have a transfer and work application in which both the work and the tool move. In this application it was decided that an electrically-operated control valve should be used since a timing cycle must be incorporated in the circuit.

In analyzing this rather complicated system you will note that it is composed of a number of relatively simple circuits which are sequenced by limit switches, timers and relays to perform the needed operation. The workpiece is moved down a gravity type conveyor until a limit switch is contacted. This starts the work cycle. Cylinder C-1 moves the workpiece over the mandrel. Cylinder C-3 causes the mandrel to be pulled up into the workpiece as air pressure is directed to the rod end of C-3. Mandrel is expanded by action of cylinder C-10. This is a rotating type of cylinder normally used on spindle applications.

When the workpiece is securely clamped, piston of cylinder C-5, which holds the locating device, advances and at the same time piston of air-hydraulic cylinder C-11 causes the mandrel to commence to rotate. This cylinder is controlled by a three-position closed center valve.

As the mandrel rotates, the locater plunger controlled





Figs. 1 and 2. Application above employs electrically-operated control valves to move the workpiece and the tool. System in Fig. 2, left, uses pilot-operated controls.

by cylinder C-5 drops into locater slot and spool in valve V-5 centers and stops piston of air-hydraulic cylinder. Piston of C-5 retracts and piston of cylinder C-4 advances, as timer is set.

At the end of the C-4 stroke, drill head cylinder advances, drills the workpiece and then retracts. Timer then causes cylinder C-4 to reciprocate five times in thoroughly brushing the workpiece. As timer cuts out, piston C-4 retracts to its starting position. Piston C-1 causes the mandrel to release the workpiece. Pistons C-3 and C-11 are returned to their original positions. Piston of cylinder C-1 retracts and piston C-7 advances, moving the workpiece onto the conveyor and then retracts. Machine is now ready for next cycle.

You will note that a number of flexible lines are used since the cylinders are being moved and the valves remain stationary. Cylinder C-11 was designated as an air-hy-

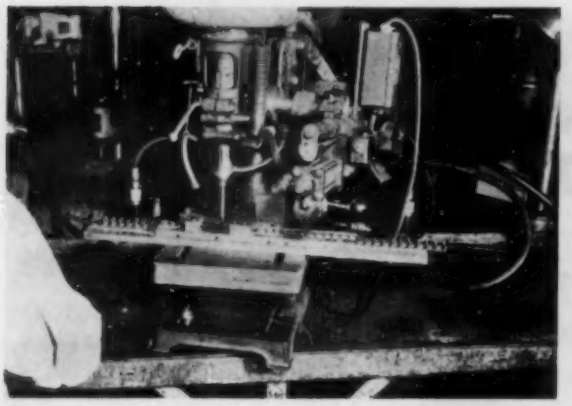


Fig. 3. Drill press feed drills 21 holes in terminal strip.

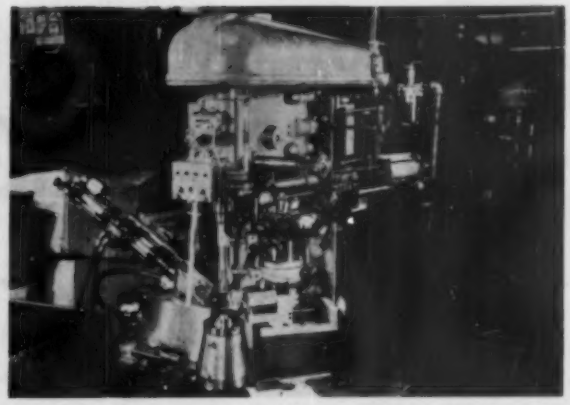


Fig. 4. Drill press is a trimming machine for shaft seals.

draulic cylinder since it is necessary to have a fine controlled feed.

In such a system it is necessary to have positive interlocks as any malfunction could cause considerable damage to a machine or to a workpiece.

In the more complicated circuits provisions should be made to cycle various parts of the system for setup purposes. Also the automatic cycle should be able to be stopped at any point in the cycle so that the machine can be cleared and a new cycle started.

While in Fig. 1 we showed one of the more complicated setups, we have other illustrations where pneumatic operations are used to effect a savings.

In Fig. 2 we make use of pilot-operated controls to effect various movements. The workpiece moves along a gravity type conveyor until it contacts an actuating arm on the two-way spring offset valve 1. This causes spool in four-way, two-position, pilot-operated valve 7 to shift and air pressure is directed to port A of actuator 10. Workpiece is then turned 90 degrees and moves off onto the second section of the conveyor.

As workpiece moves down conveyor it momentarily depresses cam roller of two-way valve 2. Spool in four-way, pilot-operated valve 8 shifts and air pressure is directed to blind end of stamp cylinder 11. As piston rod of stamp cylinder 11 advances, cam on table momentarily trips cam roller of valve 3 and spool of valve 7 is returned to its original position. Air pressure is then directed to port B of actuator 10 and the turnover device returns to its starting position. As stamp approaches workpiece, centering device centers workpiece then stamp makes contact. Cam roller on valve 4 is depressed. This causes spool in valve 8 to shift and air pressure is directed to rod end of cylinder 11 and piston retracts releasing workpiece and it moves down the conveyor.

Workpiece then contacts roller of valve 5. This causes spool of valve 9 to shift and air pressure is directed to blind end of transfer cylinder 12 and workpiece is ejected. At end of stroke of cylinder 12, roller of valve 6 is contacted and spool of valve 9 is returned to original position. This directs air pressure to rod end of 12 and piston retracts. As it retracts valve 13 is contacted so that the next cycle can start.

In this circuit numerous operations can be performed by merely adding a simple circuit for each operation to be accomplished. Very little cost is involved in setting up each additional operation.

Fig. 5. Air-operated collet is used to hold the workpiece.

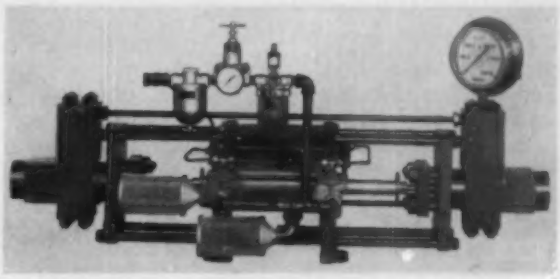


Fig. 6. Power from air cylinder actuates hydraulic pump.

In Fig. 3 a drill press feed is used. Here an operator is able to drill 21 holes in a terminal strip at a rate of better than 5000 complete parts in eight hours.

Figure 4 shows another example of what can be accomplished by converting a drill press into a trimming machine which trims both the inside and outside diameter of an elastomeric shaft seal at a rate of 10 pieces per minute. Note the amount of pneumatic equipment used.

Figure 5 shows a pneumatic-operated machine in which an air-operated collet is used for holding the workpiece. The drill head is pneumatically powered and other pneumatic equipment is used for automatically dumping the finished part onto the conveyor. Note that automatic lubricators are used.

A unique method of using pneumatic power is shown in Fig. 6. Here an air cylinder is used for providing power to actuate a high-pressure hydraulic pump. Note the compactness of this pump. **End of Series**

How to Plan
INDUSTRIAL LIGHTING

PART IV OF A SERIES

By **WILLARD ALLPHIN**, Illumination Research, Sylvania Lighting Products, Salem, Mass.

EARLIER ARTICLES in this series covered fundamentals of illumination, selecting light sources and introduced formulas for lighting design. We are now ready to apply all this information in designing lighting systems that could be used in many industrial applications.

EXAMPLE NO 1.

A warehouse is to be lighted to a minimum maintained illumination level of 10 ft-c. Because the material is in "dead storage" the lights will be used infrequently. Therefore, incandescent lamps will be used because of the lower first cost of the system. It is convenient to list the information in the same way each time one makes a layout.

Preliminary Information

Width—48 ft Length—104 ft
Mounting Height—13½ ft Maintenance—Poor
Reflectances: (per cent)
Ceiling—50 Walls—30 Floor—10
Fixture—RLM Dome Lamps—200 Watt Filament
Required Illumination—10 ft-c

Here is a case where a room ratio table such as the one in Table III requires considerable interpolation (splitting the difference). The actual formula gives:

$$\text{Room Ratio} = \frac{48 \times 104}{(13.5 - 2.5)\ (11 \times 152)} = 3.0$$

The lighting calculator slide rule makes this step easy.

Coefficients of utilization used in these examples are only intended to be illustrative. When calculating an actual job, coefficients and other data should be obtained from material provided by the manufacturer whose fixture is being used.

In this example let us say that the coefficient is found to be 0.70 for a room ratio of 3.0 and reflectances of 50, 30 and 10 per cent. The manufacturer recommends a maintenance factor of 0.60 when conditions are poor, and a maximum spacing of 1 times the mounting height above the floor. This means that the fixtures should not be more than 13½ ft apart if uniform illumination is to be obtained.

Additional Information, as Determined

Coefficient of Utilization—0.70
Maintenance Factor—0.60
Maximum Spacing—13.5 ft
Lamps per Fixture—1
Lumens per Lamp—3800

Applying the lumen formula,

$$\text{Number of Fixtures} = \frac{10 \times 48 \times 104}{1 \times 3800 \times 0.70 \times 0.60} = 31.3$$

This is rounded off to 32 fixtures. In fact, one should feel free to increase the number further, if necessary, to come out with uniform rows.

Conventional spacing has been used, in which the distance from the wall to the first row of fixtures is one-half the distance between rows, Fig. 23. Note that in both directions the spacing is within the allowable 13½ ft. Therefore, the illumination will be substantially uniform.

Fig. 23. Incandescent lamps are used in this low level warehouse design because lights will be used infrequently.

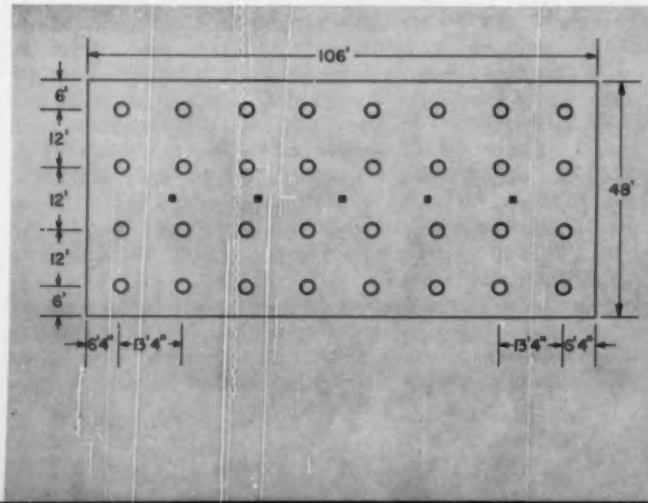
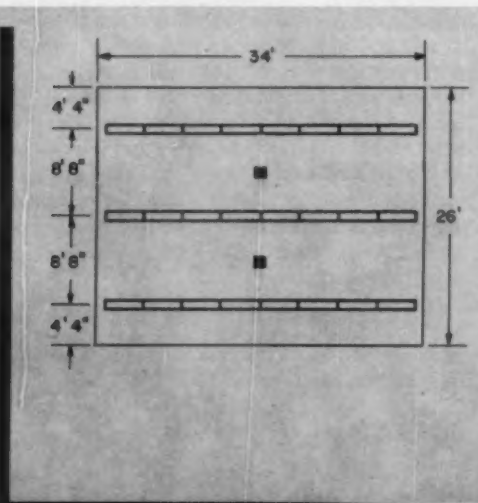


Fig. 24. Fluorescent lighting layout in a woodworking shop. Maintenance factor is low due to sawdust in area.



EXAMPLE NO 2.

A woodworking shop is to be lighted to a level of 50 footcandles with 40 Watt T12 Cool White fluorescent lamps in a fixture similar to No. 32 in Table IV. The room is 26 by 34 ft, with a ceiling height of 11 ft, and the fixtures are to be mounted 10 ft above the floor. Maintenance conditions are poor.

Preliminary Information

Width—26 ft Length—34 ft
Mounting Height—10 ft Maintenance—Poor
Reflectances: (per cent)
Ceiling—80 Walls—20 Floor—20
Fixture—Slotted industrial, with louvers
Required Illumination—50 ft-c
Lamps—40T12 Cool White

From a table like III, or from the lighting calculator slide rule, the room ratio is found to be 2.0. From the data for Fixture No. 32 in Table IV, the coefficient for 80 per cent ceiling, 20 per cent walls and 10 per cent floor would be 0.54. This is found by interpolating between the 0.52 for 10 per cent walls and the 0.56 for 30 per cent walls.

Now, a correction must be made for the 20 per cent floor reflectance. Another table (not shown) gives a correction of 6 per cent to go from a 10 per cent floor to a 30 per cent floor when the other conditions are as stated. Therefore, the increase for a 20 per cent floor will be 3 per cent. Increasing 0.54 by 3 per cent gives 0.557, but no more than two digits are used in a coefficient of utilization; and in rounding off, the more conservative value should be chosen. Therefore, the corrected coefficient is 0.55.

Maximum spacing is 0.9 times the mounting height of 10 ft, and the suggested maintenance factor is 0.60. For an actual job, the lamp lumens would be obtained from a lamp manufacturer's catalog. For these examples they are taken from Table V.

Additional Information, as Determined

Coefficient of Utilization—0.55
Maintenance Factor—0.60
Maximum Spacing—9 ft
Lamps per Fixture—2
Lumens per Lamp—2800

Applying the lumen formula:

$$\text{Number of Fixtures} = \frac{50 \times 26 \times 34}{2 \times 2800 \times 0.55 \times 0.60} = 24$$

Three continuous rows of eight fixtures each will stay within the maximum spacing of 9 ft, Fig. 24.

EXAMPLE NO 3.

Figure 25 is the weave shed of a cotton mill where the ceiling height is 12 ft, and the fixtures are to be mounted 10 ft above the floor. We are planning to use 75-watt, T12 Cool White lamps in a fixture similar to No. 31 in Table IV. Required illumination is 100 ft-c, and maintenance conditions are judged to be medium.

Preliminary Information

Width—100 ft Length—200 ft
Mounting Height—10 ft Maintenance—Medium
Reflectances: (per cent)
Ceiling—70 Walls—30 Floor—10
Fixture—Slotted industrial
Required Illumination—100 ft-c
Lamps——96T12 Cool White

Mathematically, the room ratio would come out to 8.9, but nothing greater than 5.0 is taken as a room ratio. From the data for Fixture No. 31, Table IV, the coefficient of utilization is found to be 0.76. The maintenance factor is 0.70, and the maximum spacing is 1.0 times the mounting height, or 10 ft.

Additional Information, as Determined

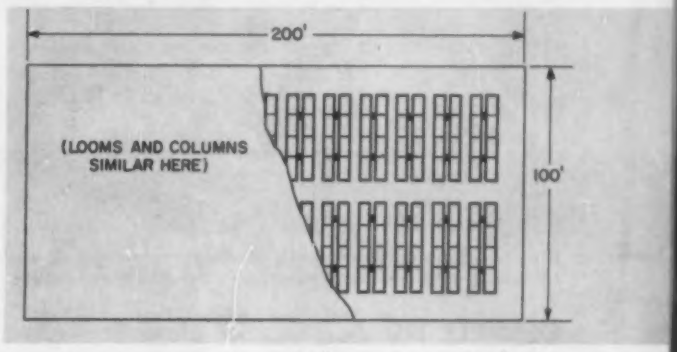
Coefficient of Utilization—0.76
Maintenance Factor—0.70
Maximum Spacing—10 ft
Lamps per Fixture—2
Lumens per Lamp—5600

Applying the lumen formula:

$$\text{Number of Fixtures} = \frac{100 \times 100 \times 200}{2 \times 5600 \times 0.76 \times 0.70} = 335$$

Since fixture rows should be installed at right angles to the looms to reduce shadows, this will work out to 14 rows of 24 fixtures, for a total of 336. See Fig. 26.

Fig. 25. Weave shed, in a cotton mill is to have 100 ft.—ceiling height is 12 ft. and fixtures to be mounted at 10 ft.



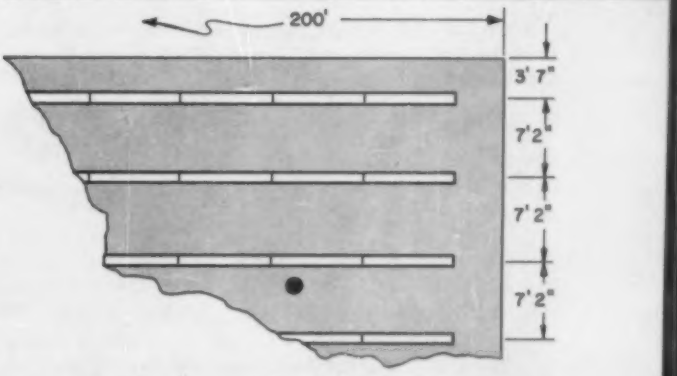


Fig. 26. Fixture rows are installed at right angles to the looms in this cotton mill weave shed to reduce shadows.

EXAMPLE NO 4.

A foundry has a very high ceiling, and the fixtures must be mounted 26 ft above the floor in order to clear the traveling crane. Because of the high mounting height and the fact that color is not important, 1000-watt clear mercury lamps are to be used.

(Continued on next page)

INDUSTRIAL LIGHTING

Preliminary Information

Width—28 ft — Length—92 ft
Mounting Height—26 ft — Maintenance—Poor
Reflectances: (per cent)
Ceiling—50 Walls—10 Floor—10
Fixture—High-bay mercury
Lamps—1000 watt BT-56 Clear
Required Illumination—75 ft-c
The room ratio is found to be 0.9, and the coefficient of utilization 0.58. The maximum spacing 0.6 times the mounting height.

Additional Information, as Determined

Coefficient of Utilization—0.58
Maintenance Factor—0.55
Maximum Spacing—15.5 ft
Lamps per Fixture—1
Lumens per Lamp—55,000

$$\text{Number of Fixtures} = \frac{75 \times 28 \times 92}{1 \times 55{,}000 \times 0.58 \times 0.55} = 11$$

Two rows of 6 fixtures will meet the conditions, Fig. 27.

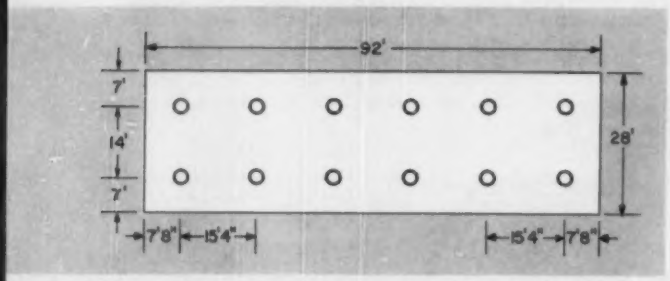


Fig. 27. Mounted 26 ft above the floor, two rows of six, 1000-watt mercury lamps produces 75 ft-c in this foundry.

EXAMPLE NO 5.

A general office is to be lighted to a level of 100 ft-c by glass-shielded troffers and 75-watt Warm White fluorescent lamps.

Preliminary Information

Width—50 ft — Length—84 ft
Ceiling Height—10 ft — Maintenance—Good
Reflectances: (per cent)
Ceiling—80 Walls—30 Floor—20
Fixture—Glass-shielded troffer
Lamps—96T12 Warm White
Required Illumination—100 ft-c
Room ratio is found to be 4.1. The coefficient of utilization would be 0.51 if the floor reflectance were 10 per cent. For a 20 per cent floor it is increased by 6 per cent, making it 0.54. Maximum spacing is 0.8 times the mounting height, which in this case is the ceiling height.

Additional Information, as Determined

Coefficient of Utilization—0.54
Maintenance Factor—0.70
Maximum Spacing—8 ft
Lamps per Fixture—2
Lumens per Lamp—5700

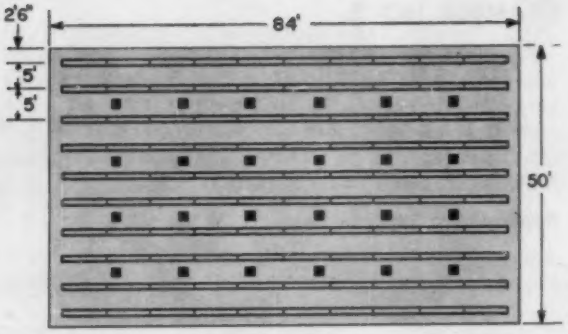


Fig. 28. Ten rows of ten fixtures are used to light this general office area to 100 ft-c with glass-shielded troffers.

$$\text{Number of Fixtures} = \frac{100 \times 50 \times 84}{2 \times 5700 \times 0.54 \times 0.70} = 98$$

Ten rows of 10 fixtures will meet the conditions, Fig. 28.

EXAMPLE NO 6.

A tool and die department is to be lighted to a level of 200 ft-c by 75-watt Cool White fluorescent lamps in 4-lamp direct-indirect fixtures.

Preliminary Information

Width—30 ft — Length—60 ft
Mounting Height—10 ft — Maintenance—Good
Reflectances: (per cent)
Ceiling—80 Walls—50 Floor—30
Fixture—direct-indirect with metal sides
Lamp—96T12 Cool White
Required Illumination—200 ft-c
The room ratio is 3.1. The coefficient of utilization, with correction for the 30 per cent floor, is 0.67, but since interreflections from the highly reflective walls and floor will be reduced somewhat by the presence of the machinery, it will be further adjusted to 0.65.

Additional Information, as Determined

Coefficient of Utilization—0.65
Maintenance Factor—0.75
Maximum Spacing—12 ft
Lamps per Fixture—4
Lumens per Lamp—5600

$$\text{Number of Fixtures} = \frac{200 \times 30 \times 60}{4 \times 5600 \times 0.65 \times 0.75} = 33$$

Five rows of 7 fixtures will satisfy the conditions, Fig. 29.

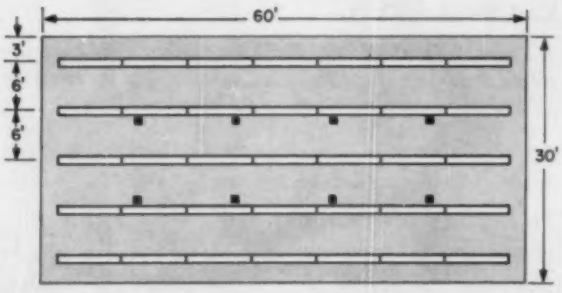


Fig. 29. Five rows of seven, four-lamp fixtures are used to illuminate this tool and die shop to 200 footcandles.

LOCAL LIGHTING

The foregoing examples have dealt with general lighting. However, if a difficult visual task would be made easier by 500 or 1000 ft-c, this does not mean that the whole room would be lighted to that level. Individual lighting units would be used to concentrate extra light at the task areas. In doing this, some precautions should be observed.

Units should be adjusted so that they will not glare into the eyes of the operator or the eyes of an operator in some other part of the room. The immediate surround of the task should be planned to reduce discomfort and disability glare. Glossy finishes which would reflect images of the light source should be avoided. The surround may need to have somewhat lower reflectance in order to offset the extra footcandles provided by the local lighting. Otherwise the surround could be uncomfortably bright in comparison with the task and the rest of the room.

Inspection Lighting

For quality inspection, general lighting with a particular degree of diffusion will sometimes be indicated. In other cases local lighting will be best. Each case must be studied on its own merits, however, a couple of general hints may be useful. Imperfections in shiny surfaces are often seen best by observing a reflection of a diffused light source in the surface. At the other extreme, scratches, dents and dings are revealed by light striking the surface from a low, glancing angle. This reveals the imperfections by causing them to cast shadows.

Color Matching

Where color is important in the inspection process, there are two common approaches. Sometimes a light source resembling some kind of natural daylight is used. In other cases a color of light may be used which exaggerates color differences in the object. Where daylight is the goal and the deluxe fluorescent lamp does not give sufficient color correction, commercial units are available which will closely match any desired color of natural daylight.

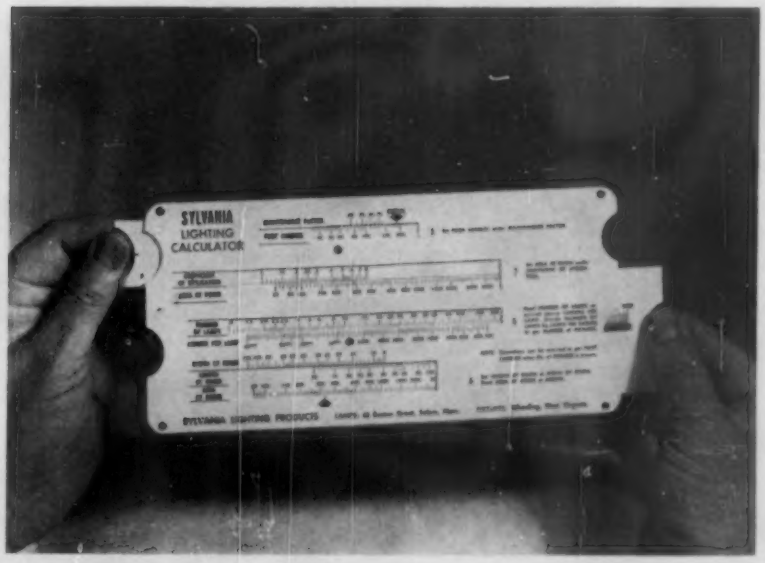
Examples of luminous ceilings have not been given because various mechanical determinations must be made in fitting such a ceiling to a particular room. Calculations, therefore, are usually made by the manufacturer's engineer. However, it may be mentioned that the theory is somewhat more complicated because a luminous ceiling is, in effect, a "membrane" between two rooms. In this sense the plenum above the ceiling is a "room" which receives light through its "floor" as well as sending light down into the working area. Coefficients of utilization are available for luminous ceilings, but care must be used in their application because the amount of clutter in the plenum space can seriously affect the resultant illumination. **End of Series**

Special Offer

To help plant engineers gain an even broader knowledge of "Industrial Lighting," the author has made special arrangements to secure copies of his book, "Primer of Lamps And Lighting" at a reduced price. This book, regularly priced at $10 is being offered at a special price of $6 to readers of this series. Make out your check to Sylvania Electric Products, Inc., and send it to Sylvania Electric Products Inc., Central Advertising Distribution, 1100 Main St., Buffalo 9, N. Y.

Last Chance for Free Lighting Calculator

Solving some of the lighting design problems contained in this last article in the series would have been easier with the lighting calculator offered free to all readers. You can still get yours by sending in a request on company letterhead to editor, Plant Engineering, 308 East James St., Barrington, Ill.



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NO CORROSION despite moisture, chemicals and vapors in the basement of this sewage disposal plant in Cleveland. Installed in 1932, this Alcoa conduit still looks almost like new.

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PLANT ENGINEERING CONFERENCE ON INDUSTRIAL LIGHTING

Chairmen, Ed Prims and Tom Hanson discuss program prior to sessions. At left, partial view of more than 100 plant engineers attending all day conference.

OVER ONE HUNDRED plant engineers in the Chicago area know a lot more about solving their industrial lighting problems as a result of attending the Industrial Lighting Conference, October 20, at the Chicago Lighting Institute. Co-sponsored by PLANT ENGINEERING and The Chicago Lighting Institute, the program featured prominent engineers from the lighting industry as well as practical plant engineers.

Basic information on planning, design and maintenance of industrial lighting systems was presented by the five morning speakers. Chairman of the morning session was Ed Prims of the Commonwealth Edison Company.

A discussion of "Illumination Levels for Industrial Tasks" was presented by Ben F. Avery, District Engineer, Large Lamp Department, General Electric Company, Chicago, to start off the conference. This talk outlined the tremendous amount of research that has been done over the past eight years by the Illuminating Engineering Society on the relation of illumination and contrast to our ability to see quickly and accurately. Currently recommended footcandle levels are based on this scientific study and a reprint of these I.E.S. standards was placed in each conference kit.

Raymond E. Wozniak, Illumination Engineer on the staff of the Chicago Lighting Institute presented a talk and demonstration on "Choice of Light Sources." Many new light sources and improved older types are available and these frequently change the economics of industrial lighting. In some cases, your lighting level can be doubled by the simple job of installing a new type of lamp in your existing fixtures. An up-to-date knowledge of all the available light sources is essential to a truly economical industrial lighting installation.

With this background information on footcandle levels

Herman E. Sereika, Lighting Consultant, Chicago Lighting Institute, demonstrates how visibility of low contrast materials improves with high recommended illumination levels.

For more facts circle 377 on Reply Card

and available light sources established, the next speaker covered "Practical Calculations for General Lighting." Presented by Richard M. Hall, Lighting Engineer, Wheeler-Fullerton, Lighting Division, Chicago, this chalkboard demonstration outlined and worked through all the steps required to calculate the number of fixtures required to obtain a given illumination level.

Special problems associated with "Lighting Low and High Bay Areas" were discussed by Robert Edwards, Application Engineers, Lighting Division, Westinghouse Electric Corporation, Cleveland. Some of these installations require careful engineering to avoid direct glare which can reduce the ability to see. Plant engineers were shown how to overcome this problem and saw examples of comfortable high and low bay lighting installations.

Last speaker in the morning session covered "Maintaining the Lighting System." This was presented by A. E. Roberts, Maintenance Superintendent, Research Laboratories, General Motors Technical Center, Warren, Michigan. Mr. Roberts is author of the article, "Methods and Procedures for Lighting System Maintenance," published in the March, 1960 issue of PLANT ENGINEERING. His talk expanded on this material and included a demonstration of a dip tank for cleaning plastic louvers. This demonstration tank was recently donated to the Chicago Lighting Institute by Sun-Ray Fluorescent Company, Chicago.

Thomas E. Hanson, Editor of PLANT ENGINEERING, served as chairman of the afternoon session which was designed to probe into more specific lighting applications. The first talk, "Lighting Hazardous Locations" was presented by Benjamin S. Benson, Director of Research and Development, Benjamin Division, Thomas Industries Inc., Des Plaines. This slide presentation covered the special problems connected with lighting areas subject to explosive fumes, high humidity and dust. Code requirements were discussed and types of equipment available to solve these problems were shown.

One of the most difficult visual tasks in industry is inspecting the finished product. The talk, "Inspection Techniques," presented by Herman E. Sereika, Lighting Consultant, Chicago Lighting institute, was accompanied by effective demonstrations to show how to overcome some of the lighting problems connected with inspection tasks.

Another important illumination problem in industry is "Lighting Employee Parking Lots and Floodlighting." Presented by Burton Benjamin, Revere Electric Mfg. Company, Chicago, this talk covered equipment and techniques available to do these jobs effectively and economically.

A different kind of problem is how to sell your management on "Benefits Derived from Good Lighting." This talk was presented by Edward G. Arsnow, Plant Engineer, Western Electric Company, Inc., North Andover, Mass. Ed Arsnow is author of a 12-page article "Industrial Lighting" published in the January, 1958 issue of PLANT ENGINEERING and has had considerable success in selling his management on good lighting installations.

Last speaker of the day was Vern Kempf, Electrical Editor, PLANT ENGINEERING, who presented a slide roundup to summarize the ideas that had been presented during the day. Looking into the future, his presentation also covered applications and economic advantages of operating fluorescent systems on higher frequencies. Later, the conference broke up into small informal groups to discuss special problems. **End**

A cut-away working exhibit of the Thompson disconnect hanger, used to speed servicing of hard-to-reach lighting, equipment, is examined by Clarence Ganz, Electrical Engineer, Plant Engineering Dept., Ryerson Steel Company.

Al Roberts, Maintenance Supt., G. M. Technical Center, demonstrates wash tank used to clean lighting equipment. Tank was recently donated by Sun-Ray Fluorescent Company.

Carl Zersen, Managing Director of the Chicago Lighting Institute, takes the floor during the informal discussion period held in a nearby hotel after the all-day conference program.

MODERN MAINTENANCE

IS PROFITABLE MAINTENANCE

R. L. Kirkpatrick, *Manager, Maintenance Sales,* Westinghouse Electric Corporation

What Do Your Maintenance Dollars Buy? Repairs Only... or Research Advances As Well?

Repaired equipment often beats its original performance. Why? Because large manufacturers like Westinghouse pass on to you the latest equipment improvements sparked by their research dollars. They make sure that repair facilities have engineering and quality control *in depth.*

If you judge solely on the basis of your repair bill, you may never know that your maintenance dollars could also include research advances. You can get radically new components, materials and techniques for your repair dollars that will lengthen operating life and cut your maintenance costs.

Building-in the findings of research means that your equipment is more than just repaired—it is modernized for maximum performance. This often means that your equipment can be rebuilt to work even better than when it was new. The latest advances in tech-

Westinghouse rebuilds "hopeless" motor

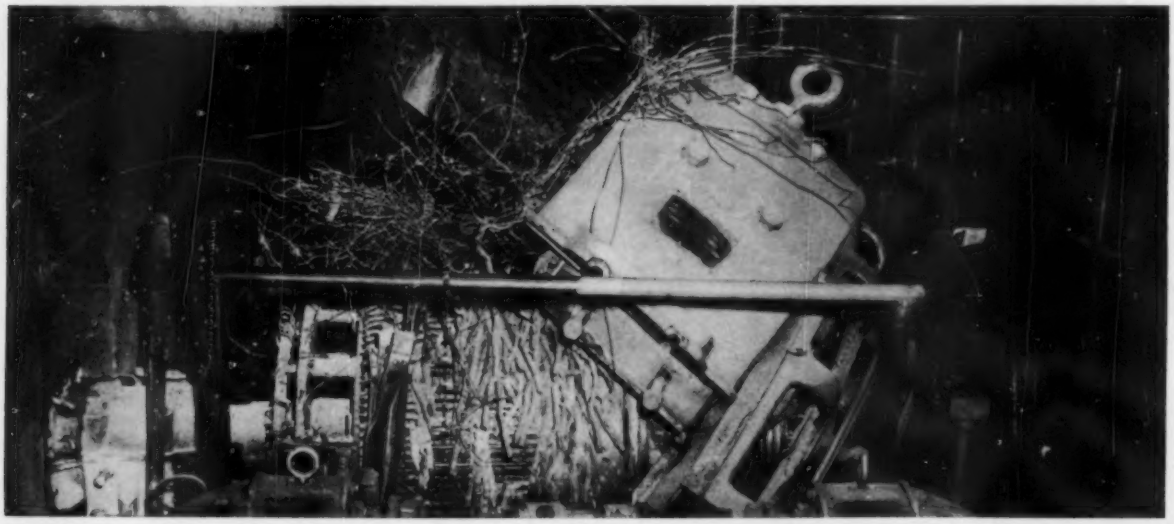
Repairs Save Customer Both Time and Money

It was a mess—this 720-hp motor serving a large steel company. Shaft shot. Armature damaged. Commutator gouged. Windings sprayed all around.

The accident occurred when a circuit breaker serving the motor jammed mechanically—failing to open when the motor lost its field.

Westinghouse maintenance experts from the St. Louis Repair Plant checked the motor carefully, decided that although the damage was extensive the motor could be economically rebuilt and put back in service in less time than replacement by a new motor. Meantime, a new Westinghouse motor, similar rating, recently delivered for a new mill, was pressed into temporary service to minimize down-time losses.

Westinghouse restored the motor to first class operating condition. Time required—a short 14 weeks. Savings to customer—estimated $11,000.



BEFORE: This sight greeted Westinghouse service engineers—a motor that apparently would never run again.

nology and engineering are incorporated in the maintenance service you receive—because large manufacturers are interested in your business in total, not just the immediate job on hand. They know that service and integrity go together—whether you buy new apparatus or need specialized service to maintain production equipment. It is imperative that they give you the latest, most modern and most reliable equipment.

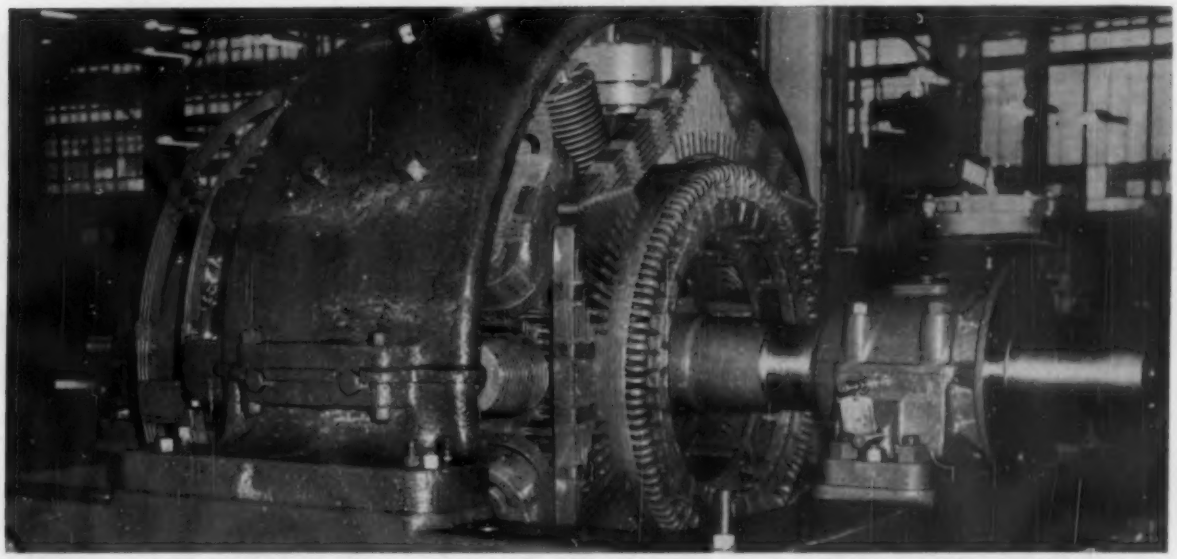
Millions of dollars are spent annually to solve equipment operating problems—to keep your equipment more reliable and on line with minimum down time. The tortuous testing of hundreds of materials (including devising the tests themselves) is constantly going on, to search for better materials and more economical ways to answer industry's needs.

Research often starts with maintenance because severe operating conditions put equipment to the supreme test. There is great advantage in working with a company experienced in solving problems under the many different conditions and in locations where they occur—even internationally. Knowledge gained in solving a particular maintenance problem becomes part of the sum total of experience that is applied to solving problems in *any* industry. It also leads to new products or equipment innovations that eliminate similar difficulties in the future.

A regular, planned schedule of modernization and repair—carried on in cooperation with a company such as Westinghouse—assures you of receiving the benefits of their research. Your equipment comes back to you with extended life that cuts maintenance costs . . . to help keep you producing profitably.

This is one of a series of Westinghouse articles on profitable maintenance practices.

—makes it better than when new



AFTER: The 720-hp motor, rebuilt and modernized by Westinghouse craftsmen, is now ready to go back on the line.

Westinghouse Maintenance Services —a Phone Call Away

Wherever you are, Westinghouse Maintenance Service is nearby, ready to work with you in the repair and modernization of your equipment—around the clock if necessary. In any industrial area of the country, you'll find Westinghouse Repair Plants, Renewal Parts Warehouses and Field Engineering Offices.

Your Westinghouse representative will show you how this fast, dependable, money-saving service can expedite your modernization and repair schedule . . . and he will assist you in setting up such a schedule. Call him . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse. J-95219

Westinghouse

For more facts circle 578 on Reply Card

CONTROLS THAT MAKE DECISIONS

By R. E. WENDT, Jr., Supervisor
Manufacturing Research,
Westinghouse Electric Corp.
Pittsburgh, Pennsylvania

MACHINES which duplicate the informed behavior of a human are being used to control complicated industrial processes. Not entirely new, the first control system designed to discover the difference between a right and wrong decision and make impartial judgments based upon its own experience was introduced several years ago.

Designed to simulate a problem analogous to a man climbing a hill in total darkness, the automatic experimeter in Fig. 1, controls two variables and measures the result. The optimum condition to be attained is the top of the hill simulated with a contour board and the two variables to be regulated are the forward or backward and the left or right steps the man can take.

By repeated experimentation, the control system successfully climbs the hill knowing only whether it has gone up or down after each step. Control systems based on these principles have been perfected and are actually in use in industrial plants.

Possible Industrial Uses

It has been recognized for some time that process operations might be improved by proper coordination of the set-point values of the controlled process variables. One function of a human operator may be to make changes in settings in order to compensate for changing conditions. To the extent that he does this, he becomes an optimizing control. An operator is, however, seldom given the necessary information or the opportunity to seek optimum settings under all conditions and at all times.

An optimizing control system attempts to get the best performance from a plant or process according to a criterion such as maximum production or minimum unit costs. It does this by adjusting the input variables, noting the effect on the performance criterion, and deciding on a logical basis what further changes of input variables should be made.

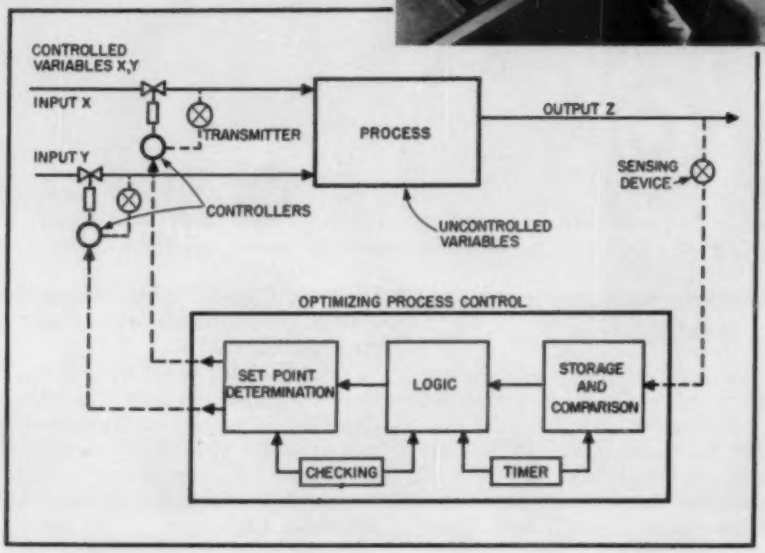
As an example, let us consider the optimization of a process operation using the block diagram, Fig. 2, for reference. The process has inputs X and Y and an output Z. Inputs X and Y are shown in this example as flows through pipes, controlled by valves which are positioned by set-point controllers. Set points of these controllers can be adjusted either manually or by a supervisory control device. The output Z is measured by an appropriate sensing device. In this example, Z is the performance characteristic which is to be maximized.

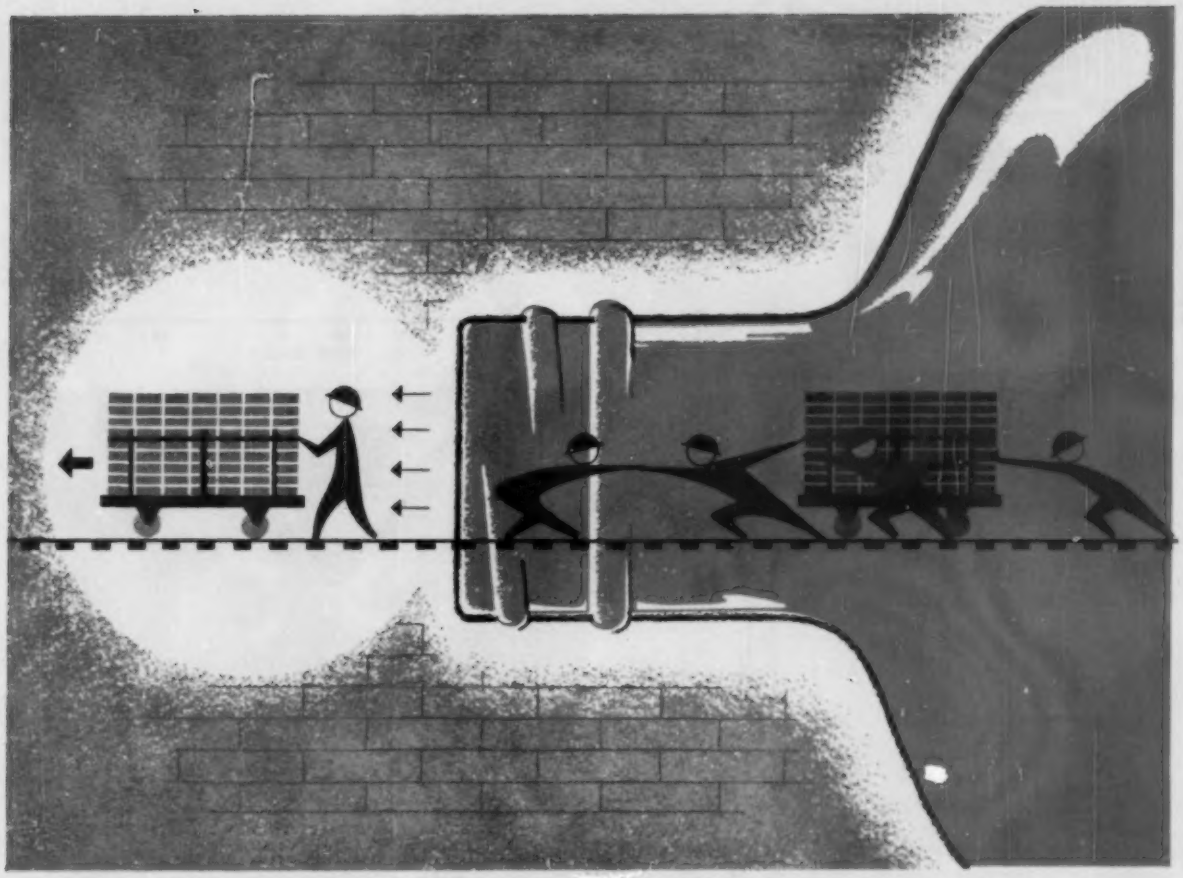
Assume that a human operator is going to attempt to maximize the output. He might start by making a change in the set points of X or Y or both. After the process and instruments have reached equilibrium, Z would be observed and compared with the previous value of Z.

A decision must then be made as to which variable or variables to move and the size and direction of the move to give the best chance of increasing Z. This sequence of making a move, observing the effect on

Fig. 1. Automatic experimeter demonstrates optimizing control principle.

Fig. 2. Block diagram of the optimizing control applied to process.





New "hot" grease ends brick-oven bottlenecks

...and one man outperforms four!

Ceramic Combustion & Engineering Company, consultants for the Davidson Brick Co., Los Angeles, California, ran into production bottlenecks while using ordinary grease in dryer-car bearings. Oven temperatures (350° to 400° F.) cooked the grease solid . . . stalled the cars loaded with bricks in the dryer. Bearings seized so badly that four men were needed to move each carload.

Now—with Shell Darina Grease 2 as the lubricant, Davidson reports: "Bearings roll free, even at 400° F., one man, instead of the four previously required, can *easily* roll a carload of bricks . . . no more bottlenecks caused by frozen bearings."

Darina® Grease 2 is an economical, multi-purpose grease with exceptional stability in high-temperature applications. It offers these outstanding qualities:

HIGH-TEMPERATURE PERFORMANCE. *100° F. better* than conventional multi-purpose greases.

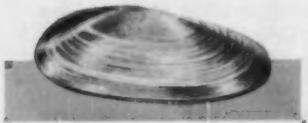
EFFICIENT SEALING. Contains no soap —nothing to melt and run out.

HIGH RESISTANCE TO WATER WASH-OUT. Doesn't dissolve or separate when mixed with water . . . lubricates efficiently under wet conditions.

POSITIVE RUST PROTECTION. Protects bearings even under severe moisture conditions.

ECONOMICAL. Savings up to 35% in grease and labor costs alone are possible because of Darina's superior performance over a wide range of plant operating conditions.

For more information on Darina Grease, write: Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.



An Interesting Fact! Every Shell Branded Industrial Lubricant is named for a sea shell. Shown here: Darina solenoides.

SHELL DARINA GREASE

the multi-purpose, high-temperature grease

SHELL

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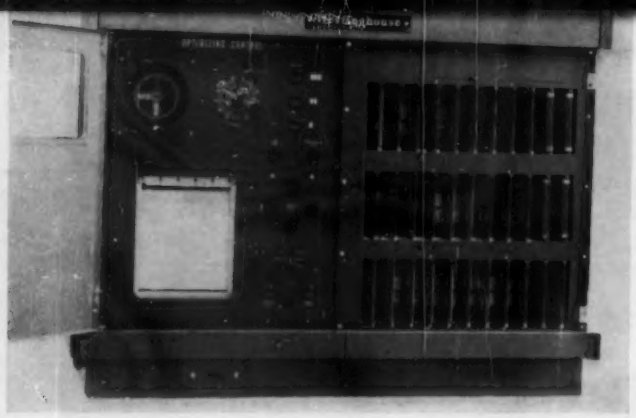

Fig. 3. Optimizing control applied to a process operation at Dow Chemical uses plug-in components.

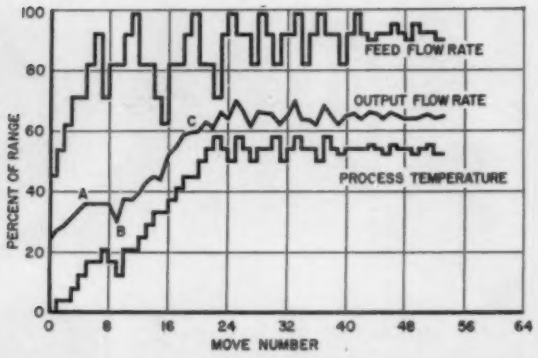

Fig. 4. Results of test run on dehydrogenation process. Feed flow and temperature govern output flow.

Fig. 5. Automatic capacitor tester uses optimizing control to balance a-c bridge network in five seconds.

the output, comparing this with previous results and making a logical decision as to the next move to make is continued until no further improvement can be noted. At this point the searching is either stopped or it can be continued to follow any drift that occurs.

This method of searching for the optimum and following drift is very similar to the way the optimizing control developed by Westinghouse Electric Corporation works. Rules by which the control system makes the logical decisions as to the move to be made after observing the effect of the last move on Z is called a strategy.

Results of only a small number of past observations are used in making decisions because older data is made useless by drifts caused by uncontrolled variables such as catalyst deterioration or change in the composition of feed. In order to compensate for drifts, continued search for the best operating point is required.

The first application of optimizing control, Fig. 3, to a chemical process has been made in cooperation with the Dow Chemical Company. The process uses catalytic dehydrogenation of ethylbenzene in the production of styrene. The controlled input variables are the feed flow rate of ethylbenzene and the temperature of the process. The output is a mixture of styrene, unconverted ethylbenzene and some contaminants. The major uncontrolled variable causing drift in this process is the deterioration of the catalyst.

Results of Test Run

Results of a test run on the dehydrogenation process are shown in Fig. 4. The move number is plotted along the abscissa while the per cent of range is plotted along the ordinate. The output flow rate of styrene increases steadily until about move 20. Thereafter, it fluctuates somewhat as the inputs change and finally settles down when the move sizes of the inputs are reduced. The process temperature is started at a low value and generally increases until about the 20th move. At about the 38th move, the step size is decreased by the optimizing control and for the remainder of the curve the temperature fluctuates around this point.

Flow rate of ethylbenzene climbs rapidly at first and then makes some rather wide swings. This is because at lower temperatures the output flow rate is not very sensitive to the feed flow rate. After a period of time, the feed flow rate has its step size reduced by the control and it continues to operate around a steady value.

Next step in the cooperative program with the Dow Chemical Company is to maximize the profit obtained from this process. In this case there will be three outputs Z-1, Z-2, and Z-3. Z-1 is the desired product and Z-2 and Z-3 are each by-products.

These outputs are measured and together with the magnitude of feed flow rate and cost data are fed to a special purpose analog computer used to solve the profit equation for the process. The output of this computer is a voltage proportional to operating profit rate of the process. The control system seeks to maximize this voltage just as it would any other process characteristic fed to it.

Another application of optimizing control is in a device to balance an a-c bridge network as part of an automatic capacitor testing facility, Fig. 5. The completely transistorized control secures a capacitance determination in less than five seconds by a procedure which approximates the work of a human operator. **End**

NOW! Plan your building in color with new Alcoa Alumalure!

Alcoa adds low-cost color to the benefits of building with aluminum. New Alcoa® Alumalure lets you choose from 11 standard colors of baked enamel on aluminum building sheet. Along with aluminum's traditional advantages—light weight, corrosion resistance and economy—you'll gain the exciting appeal of color that transforms any building into a showplace. Be among the first to get the facts on Alumalure*, Alcoa's latest contribution to architecture. A telephone call to your local Alcoa sales office will bring you complete information.

FREE!

Color-Swatch Folder illustrates all 11 exciting Alumalure colors. Get it from your local Alcoa sales representative or write on your company letterhead directly to: Aluminum Company of America, 822-M Alcoa Bldg., Pittsburgh 19, Pa.

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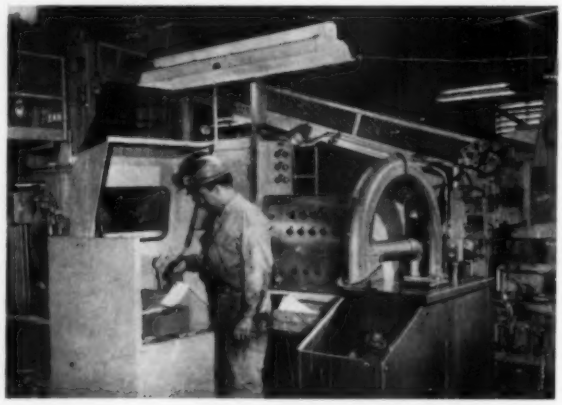
News from the Plants

Electronic Computer Calculates "Recipe" for Making Steel

INSTALLED AT the Aliquippa, Pa., works of Jones & Laughlin Steel Corporation, a new electronic computer works out the proper "recipe" for making steel in the basic oxygen furnace.

The special-purpose analog computer calculates the proper proportions of hot metal, scrap and lime to be charged into the furnace so any desired type of steel may be tapped at the desired temperature. The tapping or finishing temperature in this new steelmaking process plays an important role in the quality of the product.

To compute the charge for a heat of steel, the Melter at the Basic Oxygen Furnace Department sets the computer's potentiometers for the desired charge weight, tap temperature, basicity ratio, lance height, scale and ore additions plus the measured iron silicon, iron manganese and iron temperature. The advance control button then is pressed. This places the computer in the "print" mode where all inputs are recorded on paper tape.



After the print operation, which requires approximately five seconds, the control button advances the computer to the "compute" position where the control equations are solved for the given input conditions. When the operator pushes the control button three more times, the computer displays, in turn, the quantities of scrap, hot metal and lime.

Optically Pure Germanium Disc Extends Scope of Infrared Sensor

THE WORLD'S largest "picture window" to invisible infrared radiation, used in detection systems for missile guidance and space surveillance, has been produced by Hughes Aircraft Company, Culver City, Calif.

The window, a solid casting of germanium 15 in. in diameter and one-half inch thick, will extend the scope of infrared sensors which until now, have been limited in lateral angle of vision by much smaller viewing devices. The germanium development can be compared to a picture window replacing a narrow porthole.

Although not transparent to the human eye, the germanium casting is optically clear for "seeing" infrared wavelengths. In order to collect and focus infrared rays, the material used must be able to refract them with the efficiency of glass lenses used for collecting and focusing visible light rays.

After the germanium casting left the mold, it was optically ground and polished by a technique similar to that of a fine glass lens, then adapted to an infrared sensor.

Mile-Long Rubber Conveyor Belt Moves Fill to Dam Site

THIS CONVEYOR belt is nearly a mile long. It is used for moving 20 million tons of earth in a remote stretch of northern New Mexico, and when the job is finished the conveyor system will be completely dismantled—after working only 350 days.

The belt, made by United States Rubber Co., moves fill for the huge Abiquiu Dam project. The dam is located about a mile and a half from the gravel pits. Between these points the belt is moving three times as much fill as was needed for the Hoover Dam.

Carrying the materials at 800 fpm, the belt climbs from its loading end to a height of 100 ft, drops to cross Canones Creek some 70 ft over the water, then climbs another 90 ft higher for the end of its run. From beginning to end, the belt moves the material 4315 ft.

Construction of the earthen Abiquiu Dam is being handled by Mittry Construction Co. of Los Angeles, awarded the job by the U. S. Army Corps of Engineers. The Conveyor Co. of Los Angeles designed and built the conveyor system, with U. S. Rubber engineers designing and building the high-tension belt.

For more facts circle 580 on Reply Card

See why Pittsburgh Corning Products make the things you build look better, last longer, cost less

example: NEW FOAMGLAS-BOARD™ Roof Insulation

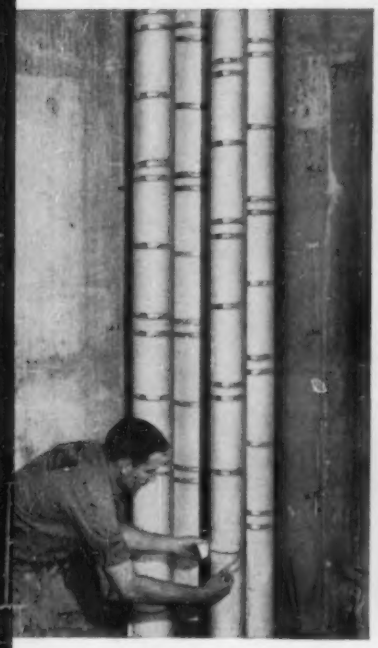
The acknowledged quality of FOAMGLAS is now available in a new, reduced thickness in a large unit size which reduces the number of roof insulation joints and promotes fast, economical handling and installation. FOAMGLAS-BOARD is composed of multiple blocks of FOAMGLAS, 1½" thick, faced on each side with a special asphalt-laminated paper.

FOAMGLAS-BOARD has been approved by the Associated Factory Mutual Fire Insurance Companies for Class I insulated steel roof deck construction when applied with hot asphalt.

A new brochure contains complete information. For a copy, simply mail the coupon on the fourth page of this advertisement.

PITTSBURGH CORNING

example: FOAMGLAS® Stay-Dry Pipe Insulation to design five important benefits into all building service lines



Insulation for building service lines—iced water, chilled water, low pressure steam or dual temperature—has frequently proved a maintenance headache. Now you can design away that headache with FOAMGLAS Stay-Dry Pipe Insulation and its combination of five critical benefits. First, since FOAMGLAS is incombustible and the jacket self-extinguishing, FOAMGLAS Stay-Dry Pipe Insulation substantially reduces fire hazards. Second, constant insulating value results from the absolute imperviousness of FOAMGLAS to all moisture. Separate vapor seals are unnecessary.

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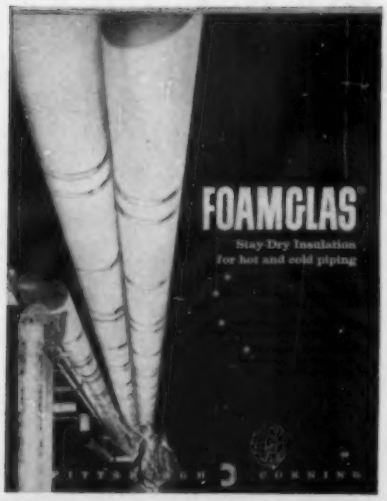
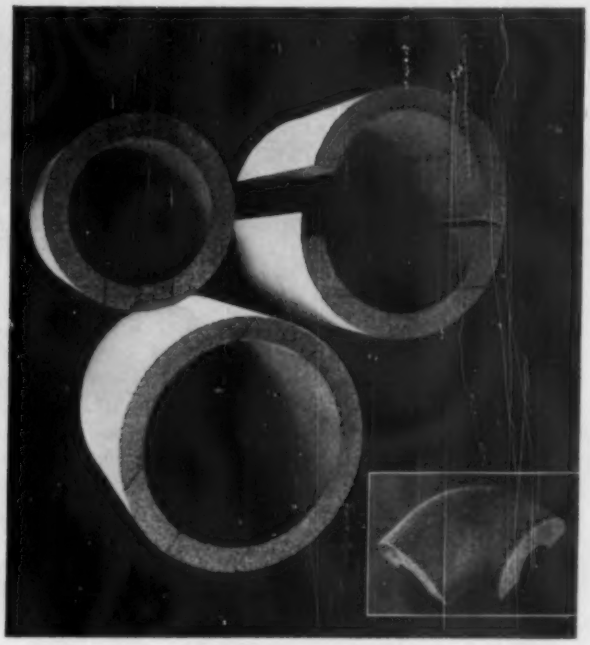


Check the coupon on the next page to obtain this brand new catalog containing complete specification and installation data on FOAMGLAS Stay-Dry Pipe Insulation.



Next is the elimination of all weak spots in piping runs. The extraordinary compressive strength of FOAMGLAS prevents slump or sag on the highest vertical runs and saddle supports can never puncture the insulation. Fourth, the insulation is furnished with a factory applied Kraft-foil jacket. And fifth, all these benefits can be applied to total piping systems since FOAMGLAS Stay-Dry Pipe Insulation is available in sizes from ½″ copper tubing to 12″ IPS with fitting covers and elbows to match.

CORNING

example: PC Glass Block Panels bring four important benefits to Electric Boat

Even density lighting, good atmospheric control, attractive appearance and minimum maintenance. These benefits have proved the soundness of the decision by Electric Boat Company, Division of General Dynamics, to use PC Glass Blocks for new panels and sash replacement at their Groton, Conn., plant. Attractive on the outside, the Glass Block panels have virtually eliminated morning glare and afternoon shadow in laboratories and working areas.

The excellent insulating value of the blocks makes it far easier to insure accurate, pressurized atmospheric control within the building. Maintenance has been negligible . . . with nothing to rust, rot or need painting . . . and not a single instance of breakage or structural failure in the glass block panels.

This kind of experience makes PC Glass Block panels the odds-on favorite to eliminate window problems in virtually any type of industrial plant or commercial building.

Take advantage of the coupon on the fourth page of this advertisement.

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Please send me descriptive literature on the products checked below.

- ☐ FOAMGLAS-BOARD ™
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- ☐ FOAMGLAS Stay-Dry Pipe Insulation for Building Service Lines
- ☐ FOAMGLAS Insulation for Curtain Wall Panels
- ☐ PC GLASS BLOCKS
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- ☐ FOAMSIL,® the Acid-proof Insulating Refractory
- ☐ PC Sculptured Glass Modules
- ☐ GEOCOUSTIC ™

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PITTSBURGH PC CORNING

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INDUSTRIAL PLANT CONSTRUCTION.— information on location, costs

Richmond, Calif.—Standard Oil Company of California, through its subsidiary California Chemical Company, has authorized construction of two chemical plants at company's Richmond Refinery to cost a total of nearly $17 million. The plants are scheduled for completion early in 1962 and will increase annual output of paraxylene by 41 million pounds and orthoxylene by about 100 million pounds.

Wilmington, Del.—E. I. du Pont de Nemours Co., Du Pont Building, will start construction at once on a physical research laboratory for central research at company's experimental station located here. New structure will provide specialized facilities for research in ferromagnetism, crystal physics, molecular structure and bonding as well as detailed studies of the properties of the new materials and their uses. New facility is scheduled for completion by the summer of 1961.

Wilmington, Del.—Bestwall Gypsum Co., Ardmore, Pa., plans to construct a building products plants at this city's marine terminal. Plant will be designed to manufacture 150 million sq ft of gypsum wallboard, lath and sheathing annually as well as gypsum wall plasters, graded commercial rock and agricultural gypsum. Work will begin at once for completion scheduled for the fourth quarter of 1961. Plant when completed will represent an investment of $7.5 million.

Chicago, Ill.—Armour & Company, 1353 W. 31st St, plans an expenditure of some $60 million for the expansion of company's Agricultural Chemical Company Division. New facilities, which will triple production of phosphates and nitrogen by 1962, account for the major portion of the program. A large nitrogen plant will be built at Sheffield, Ala., and the phosphate operation will be added to an existing company operation in Polk County, Fla.

Chicago, Ill.—Brunswick Corporation, 623 S. Wabash Ave., this city, plans to construct two new manufacturing plants and two additional regional warehouses. All facilities are being built for lease to the company for its bowling and outdoor recreational divisions. The company's initial outlay will be about $500,000 to equip the plants. An 82,000-sq ft golf ball manufacturing plant at Covington, Ga., will begin operations by April 1961. The second plant, a 166,000-sq ft facility at Eminence, Ky., will manufacture Red Head brand clothing and accessories when completed in early 1961. Regional warehouses are being constructed in Chicago and Los Angeles to serve as distributing centers.

Fort Wayne, Ind.—Rea Magnet Wire Co., Inc., 3491 E. Pontiac Rd., this city, subsidiary of Aluminum Company of America, Pittsburgh, Pa., plans to construct a new research laboratory to serve the electrical industry. Company has recently purchased a large building site about 2½ miles from company's Fort Wayne Works and main office southeast of the city. Work on the facility will begin soon and is targeted for completion late in 1961.

Portage, Ind.—Midwest Steel Corporation, a division of National Steel Corp., Pittsburgh, Pa., will erect a complete pickling line at company plant located here. Contract was awarded to the David W. Murray Co., Cleveland, O. Construction will get under way at once and completion is scheduled for early 1962.

Louisville, Ky.—Rohm & Haas Co., 712 Locust St., Philadelphia, Pa., has authorized a one-year construction program to cost in excess of $12 million to renovate and enlarge a Government surplus plant recently purchased. The plant will make methyl methacrylate monomer, Plexiglas acrylic molding powder and ammonium sulfate, a byproduct of monomer manufacturing. Plant is scheduled to be ready for occupancy sometime in the summer of 1961.

Acton, Mass.—Air Reduction Co., Inc., 150 E. 42nd St., New York, N. Y., plans an expenditure of $5 million for tripling production of nitrogen and argon gas and on distribution facilities at company plant here. Plant's capacity will be increased to 205 tons per day of oxygen, nitrogen, argon and other gases from 75 tons currently produced. In the new expansion, $2 million will go for production facilities and $3 million for distribution facilities.

New Bedford, Mass.—Quaker Oats Co., Merchandise Mart Plaza, Chicago, Ill., plans to erect a large manufacturing plant here for the production of cat food. The proposed plant will cost about $1.5 million and will process about 15,000 tons of fresh fish annually. Construction work will get under way soon for completion before 1962.

Muskegon, Mich.—Bemis Bros. Bag Co., 408 Pine St., St. Louis, Mo., plans an expenditure of $1.25 million on a plant and modernization program at six different company locations, largest of which will be a $300,000 plant for the production of molded cellulose to be constructed here. Included in the plans are additional warehouse and production facilities at Vancouver, Wash., expansion of the paper mill at Claremont, N. H., a plant addition at Flemington, N. J., and a small expansion of the packaging service plant at Minneapolis, Minn.

Omaha, Neb.—Western Electric Co., 195 Broadway, New York, N. Y., has purchased a 26-acre plant site here on which it proposes to construct a telephone distribution center. Construction will start in 1961 and will continue through 1962. When completed, at a cost of $2 million, the facility will serve the Nebraska, Iowa, and South Dakota areas of Northwestern Bell Telephone Co.

Pennsauken, N. J.—Standard Brands, Inc., 595 Madison Ave., New York, N. Y., plans to construct a large margarine manufacturing plant here. The structure, with a floor area of 53,000 sq ft, will be erected on a 17.6-acre plot. Plant to cost in excess of $2-million is scheduled to go into production before June, 1961.

Albuquerque, N. M.—Sparton Corporation, 2301 E. Michigan Ave., Jackson, Mich., will start construction soon on a manufacturing plant for the production of electronic and mechanical components for defense items. Plant will be constructed on a 20-acre site recently acquired for the purpose. Work on the new structure to cost in excess of $1 million will be completed in 1962.

Niagara Falls, N. Y.—Pyron Corporation, 53rd & Price Streets, this city, a unit of the Amoco Division of American Metal Climax, Inc., will construct a new highly automated iron powder plant here. The new facility will cost approximately $2 million upon completion in 1961.

Addyston, O.—Monsanto Chemical Co., 1700 S. Second St., St. Louis, Mo., has begun construction on a multi-million dollar plant near Cincinnati, for the manufacture of plastics. New plant will increase company's domestic production of heat-resistant and high impact styrene molding and extrusion materials.

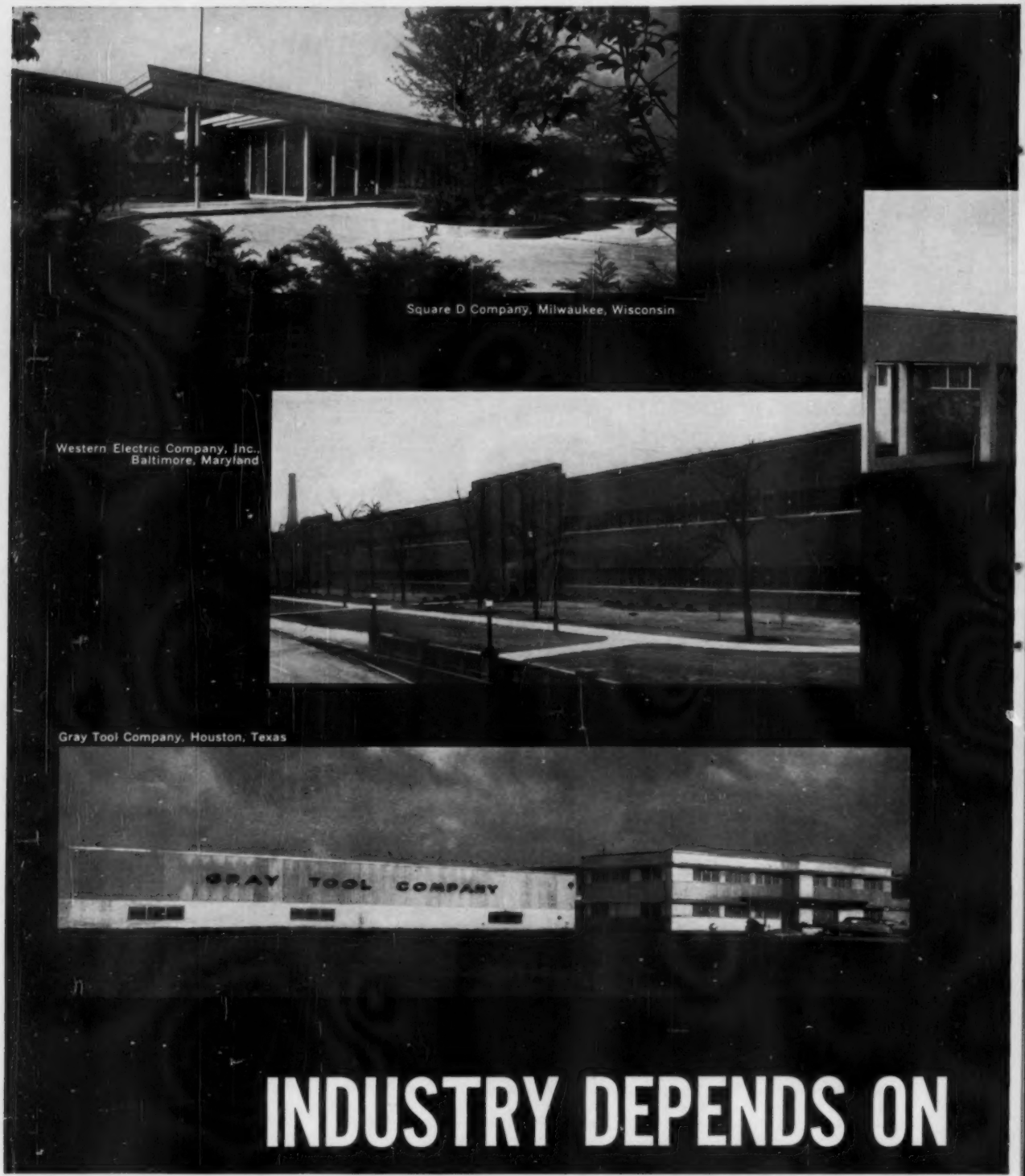
Cleveland, O.—Brush Beryllium Company, 4303 Perkins Ave., plans to construct a $3-million plant to finish, fabricate and machine beryllium metal. Plant which will have 90,000 sq ft of floor space will consolidate operations currently housed in three separate shops. Work on the new facility is scheduled for completion by the spring of 1961.

Hubbard, O.—Sherwin-Williams Co., 101 Prospect Ave., N. W., Cleveland, O., plans to construct a new addition to company's local container plant located near here. Plant engaged in the manufacture of buckets and pails for the paint and varnish produced by the company, will boost capacity to 3 million containers a year on a one shift basis. Plant addition will cost approximately $650,000 when completed early in 1961.

Chambersburg, Pa.—American Can Company, 100 Park Ave., New York, N. Y., will start construction at once on a 145,000- sq ft plant here for the manufacture of packaging materials for food. Plant when completed will turn out a diverse range of plain and printed paperboard packaging materials.

Philadelphia, Pa.—Wyeth Laboratories, subsidiary of American Home Products, 22 E. 40th St., New York, N. Y., has

(Continued on page 225)

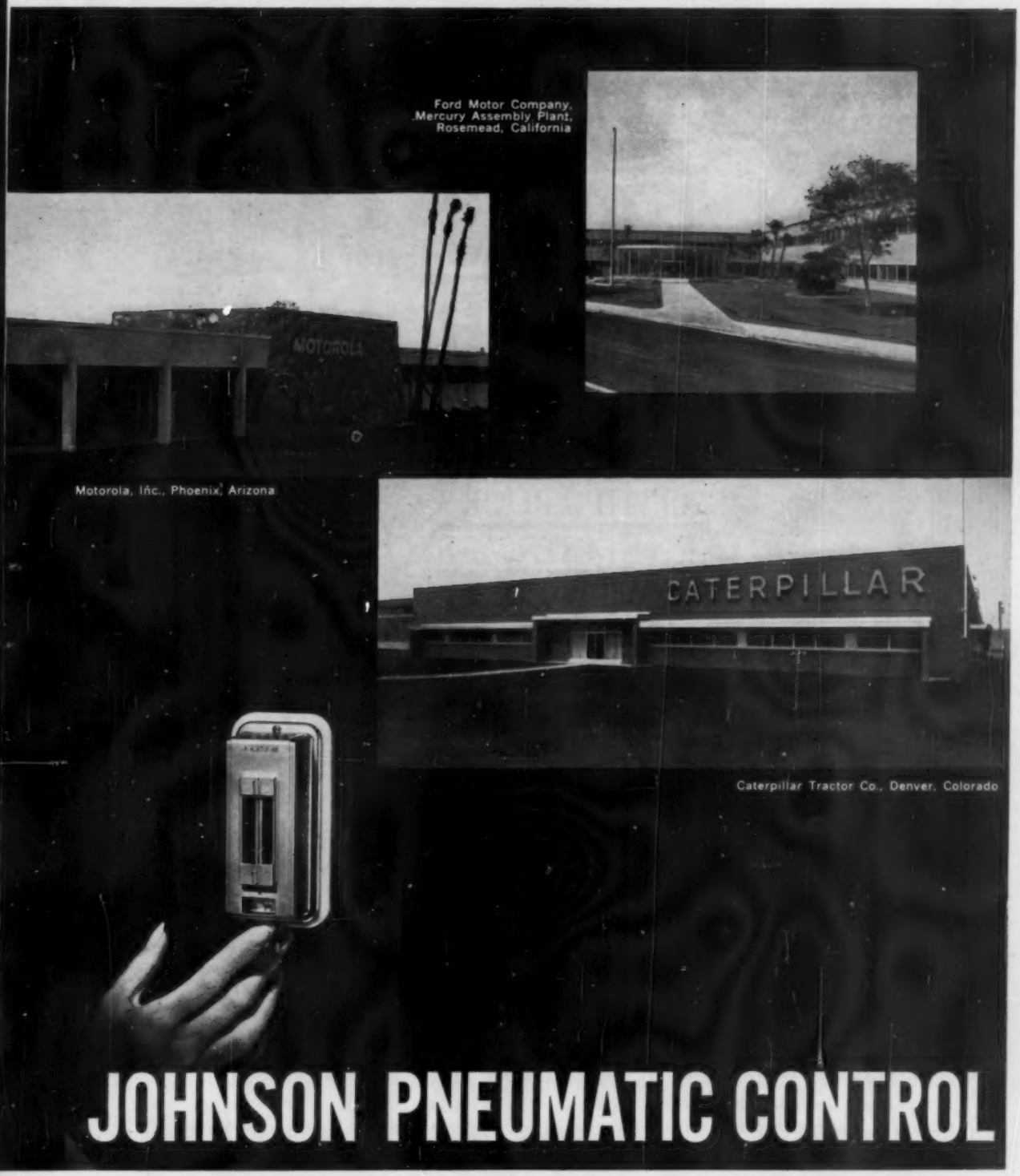


INDUSTRY DEPENDS ON

Increased productivity, lower employee turnover, reduced absenteeism, improved machine efficiency, better quality control — all these and more often are possible in modern industrial plants that have a closely controlled thermal environment.

Johnson Pneumatic Control Systems have a notable record for providing dependable, trouble-free operation of all types of industrial air conditioning, heating, and ventilating systems. Thousands of leading plants such as those shown here depend on specially planned Johnson Systems to meet their individual temperature and humidity control requirements.

Johnson manufactures the most complete line of pneumatic controls for solving any problem of temperature, humidity, or pressure control. And, to make certain that each installation continues to perform up to expectations, Johnson maintains the largest and most experienced service organization in its field.



Let Johnson help provide a more productive thermal environment in your plant. Whether your problems involve comfort control or the regulation of process air conditioning, a specially engineered and installed Johnson Pneumatic Control System is the answer. Your consulting engineer, architect, or local Johnson representative can give you full details. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in 105 Principal Cities.

JOHNSON CONTROL

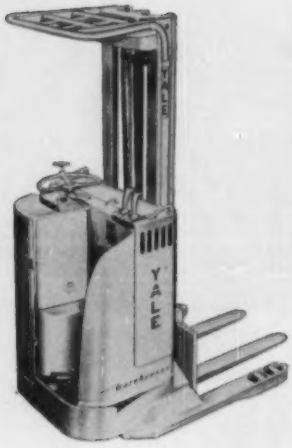
PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

For more facts circle 582 on Reply Card

YALE TRUCKS LEASED

ON PLANS AS VARIED AS THE TRUCKS THEMSELVES



One of the following Four Flexible Finance Plans will put any Yale Truck to work earning profits for you immediately. The advantages of each plan, outlined here, will help you decide which plan best meets your requirements. Look them over.

1 **Time Payment Plan.** Under this plan you make a small down payment and the truck is delivered. Thereafter you make monthly payments adjusted, within reasonable limits, to your requirements.

2 **Leasing Plan.** Under this plan you can lease a Yale gas or electric truck for a period up to 5 years with renewal options available for additional periods. Rates of payments are flexible to meet your needs.

3 **Leasing Plan with Purchase Option.** Under this plan you get the advantages of a straight leasing plan on pre-arranged monthly payments. But you can arrange for title of ownership to the truck by paying a small additional sum at the end of the lease.

4 **Leasing Plan with Maintenance.** Under this plan you can lease a Yale truck on terms outlined in Plan 2 or 3. But for an additional sum you can obtain full maintenance including all repairs, replacement of parts, and labor costs.

These Four Flexible Finance Plans represent the basic financial terms under which Yale trucks are leased. However, if you are confronted with unusual circumstances, we will make every effort to arrange a special plan "tailored" to your specific needs. But whichever Yale plan you decide upon, remember that you will have the best in lift truck equipment powered by gas, electricity, Diesel or LP gas. For more information write to your nearest Yale dealer or to us direct.

Yale Materials Handling Division, a Division of the Yale & Towne Manufacturing Company, Dept. X-010, Philadelphia 15, Pa.

YALE®
INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS - HOISTS
YALE & TOWNE

For more facts circle 588 on Reply Card

For more facts circle 583 on Reply Card ⟶

At Amana Refrigeration, Inc.

STANOIL

IMPROVES PRODUCTION
REDUCES MAINTENANCE

Smooths operation of 600 ton hydraulic press

Situation: The 600 ton Verson Press at Amana is a vital operating component in the manufacture of home freezers and refrigerators. Its proper performance is necessary to the efficiency of Amana's entire manufacturing operation. That's why erratic press operation, caused by foaming of the hydraulic oil, was a serious problem.

What was done? In seeking the solution to this problem, Amana consulted their Standard Oil lubrication specialist who recommended STANOIL for this service. STANOIL Industrial Oil is a top quality, first-line industrial lubricating and hydraulic oil. It will provide excellent service in many different applications. And when tested by Amana, STANOIL proved perfect for use.

What has happened? Since STANOIL was first put to work at Amana, it has performed for extended periods of time without foaming or oxidation, lengthening the time between drainings and improving press operation. As a result of this record, STANOIL has been adopted for use on other production equipment, together with Standard's RYKON Greases and SUPERLA Soluble Oil.

What you can do: To get help in solving your lubrication problems and to learn more about STANOIL Industrial Oils, simply call the Standard Oil office near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.**

You expect more from STANDARD and you get it!

Standard's Jess Nelson (center) and Gene Maske (left) checking lubrication survey with Leonard Rettig, Amana's plant maintenance superintendent. Jess, who is District Engineer for Standard, is a specialist in this kind of operation. He has an engineering degree from the University of Iowa, and has also graduated from the Standard Oil Sales Engineering School.

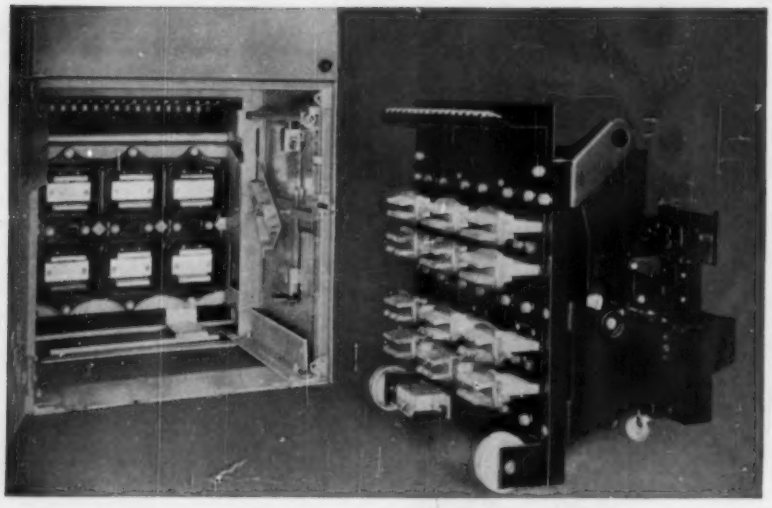
Maximum Value in Switchgear Flexibility... Safety...

Westinghouse low-voltage, metal-enclosed switchgear is modern inside and out . . . loaded with features to assure you of a high return on your investment.

Absolute mechanical and electrical integrity is guaranteed with 100% use of Westinghouse components. Design performance is thoroughly proved in exhaustive tests at the Westinghouse High Power Laboratory.

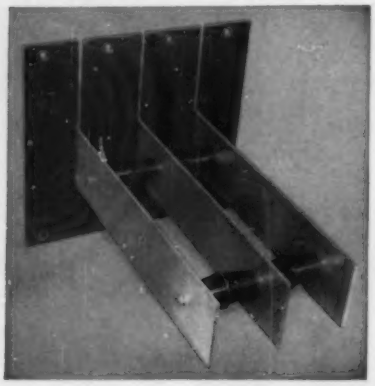
Minimum cost is possible by specifying "Standardized" over-all design. Westinghouse "Standardized" switchgear meets all normal requirements within its rated interrupting capacity . . . eliminates additional engineering and manufacturing costs of expensive "specials."

Nationwide switchgear manufacturing plants are ready to serve you . . . convenient for consultation and inspection during equipment construction. All units are thoroughly tested for conformity to NEMA standards. Where conditions permit,



Cluster-Type Disconnect Fingers permit quick inspection when breaker is withdrawn from cell. A spring-mounted floating retainer maintains full contact pressure and assures maximum current rating capacity despite minor variations in breaker alignment.

Glass Polyester Bus Supports and Short Circuit Bracing . . . provide ideal physical and electrical properties for low-voltage, metal-enclosed switchgear. The insulation is highly track resistant and flame retardant. Design of supports and bracing affords increased vertical creepage distances. Result: maximum safety with minimum maintenance.



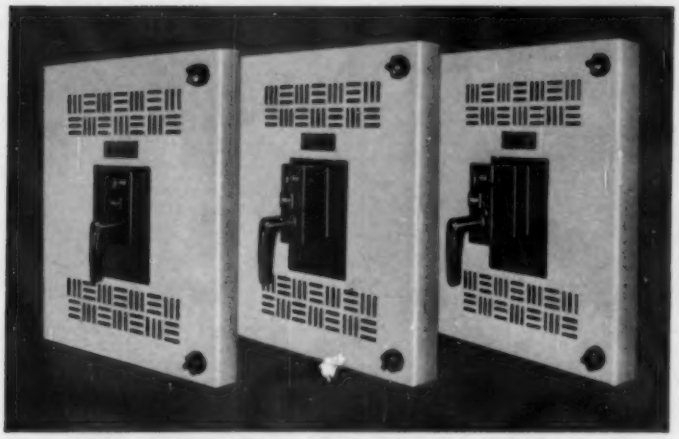
Long-Term Operating Economy

switchgear is shipped as one completely assembled apparatus.

And, mighty important . . . *Westinghouse assumes complete, undivided responsibility for the switchgear* from planning to the satisfactory overall operation of the installed equipment. For detailed information on low-voltage, metal-enclosed switchgear, call your Westinghouse sales engineer, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

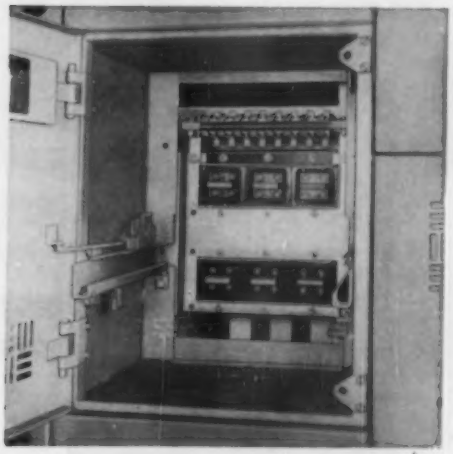
J-60004-H

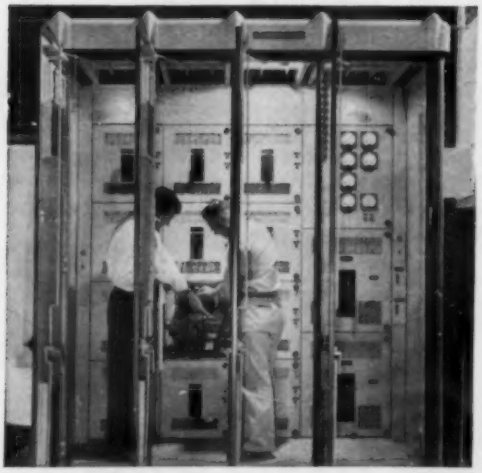
YOU CAN BE SURE...IF IT'S Westinghouse



Three-Position Drawout Design permits the De-ion® type DB breakers to be in "connected"—"test"—or "disconnected" position with the breaker door closed. The breaker can be tested in complete safety and storage space for the breaker is also provided when in fully disconnected position.

Individual Breaker Compartments include interlocks and positioning devices to assure safe removal or replacement of breakers. Dead-front design provides maximum protection and safety for operators and equipment.





"Walk-In" Aisle provides protected work space in outdoor units. Addition of this space to the weatherproof, functional design permits easy inspection and maintenance without exposure of equipment or personnel under all weather conditions.

Three Breaker Closing Mechanisms are available to match your requirements—dependent manual, independent manual, or electric—for DB-15, DB-25 and DB-50 breakers. NEMA standards specify electric mechanism for closing DB-75 and DB-100 breakers. The independent manual mechanism, shown below, assures uniform breaker operation—regardless of operator's motion—prevents delayed closing and excessive contact burning.

For more facts circle 584 on Reply Card

PLANT ENGINEERING EQUIPMENT.

Edited by M. E. Heniken

OVERHEAD GARAGE DOOR has colorful translucent panels

Filuma is a sectional overhead door with reinforced fiber glass panels said to light up a garage interior like a skylight. It comes in sizes up to 14 ft wide and high. The panels, available in five colors, are encased in extruded aluminum. According to company, the Filuma weighs about a third as much

as comparable wood doors, enabling easier manual operation or efficient automatic operation with a small power unit. Panels require neither glazing or painting. The track is galvanized and hardware is zinc-plated, except for track reinforcing angles. Only 11½ in. of headroom is required, with side clearance of 4 in., and centerpost, 8 in. Form 0199 gives full information. Frantz Mfg. Co.

For details, circle 1 on Post Card

ACOUSTICAL BOARD for use on suspended ceilings

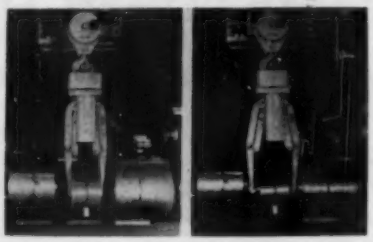
This incombustible acoustical gypsum ceiling board, reinforced with glass fibers, is designed for use with metal grid systems for suspended ceilings. The perforated ceiling board is available in 24-by-24 in. units of ⅜ in. thickness, has washable white surface and comes in a flat and lightly textured finish. A 70 per cent noise reduction coefficient and a 78 per cent light reflection coefficient are claimed. Units are removable for access to air conditioning ducts, pipes and utility lines. Bestwall Gypsum Co.

For details, circle 2 on Post Card

FLOOR RESURFACER resists chemicals, abrasion

Zelonide is announced as a dimensionally stable, thermosetting plastic floor topping with adhesive qualities and toughness needed to resist most acids, alkalis, oils, greases and detergents as well as thermal shock and moisture. It bonds firmly to concrete, metal and wood, company says, forming a hard, dense surface which withstands wet heat to 212 F. Under most conditions it is ready for traffic within 24 hr. The Monroe Co.

For details, circle 3 on Post Card



COIL LIFTERS with tong action, motorized swivels

Only one man—the crane operator—is required to work the lifter shown. The units are designed with lifting legs that are in vertical position at any opening, letting the crane operator pick up or set down a coil using a minimum of space, as little as 10 to 12 in. between stacks of coils, regardless of coil widths. Motor operation of lifter and swivel enables crane operator to grab, lift, carry and rotate, set down and release load faster and more safely, company notes. Cullen-Friestedt Co.

For details, circle 5 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 227-228.

POSITIONING CONTROL is electro-mechanical servo

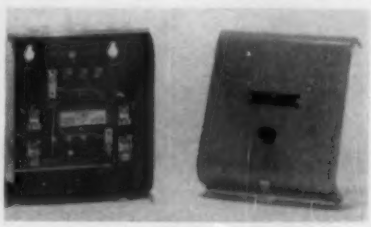
The Hanna-Powr Positioner, Model PR2 A, is for automatic positioning of machine tools, valves, float levels, etc., at any of several predetermined positions, corresponding to a control selector switch signal. It is used with such power mechanisms as an air or hydraulic cylinder, along with solenoid valves applied to operate a pipeline flow valve. In the illustration, this multiple positioner is installed on a fluid power cylinder to regulate a pipe line valve by remote control. The position selector control box, shown at lower right, may be located miles away. Each of its buttons regulates the valve at different positions. Readout lights under the switch buttons give a return signal when position is achieved.

The positioner is a two-cam-rod device in which the rod ends trip limit switches as the rods slide back and forth inside channel grooves. There may be up to 14 sets of limit switches per foot (thus 14 positioning stops) in the positioner, which may be up to 8 ft long. Adjustments of limit switches to change position stops are made by loosening two screws and moving the switches. The unit is said to achieve position accuracies of ± 0.005 in., depending on mass and weight of load or type of application. Manufacturer points out that a cam-rod type positioner with four sets of adjustable position switches costs about a third as much as installing eight individual comparable switches on an industrial machine. Hanna Engineering Works.

For details, circle 4 on Post Card

MAGNETIC STARTERS for low-horsepower service

Size 00 magnetic contactors and starters for low-horsepower light duty applications have been added to this company's 100 line. For controlling conveyors, small pumps and fans, the Size 00 starter is said to



offer about an 18 per cent price saving over the Size 0 starter which might have been used previously for such applications. Starters and contactors are designed for easier installation, less maintenance, and straight-out-the-front disassembly.

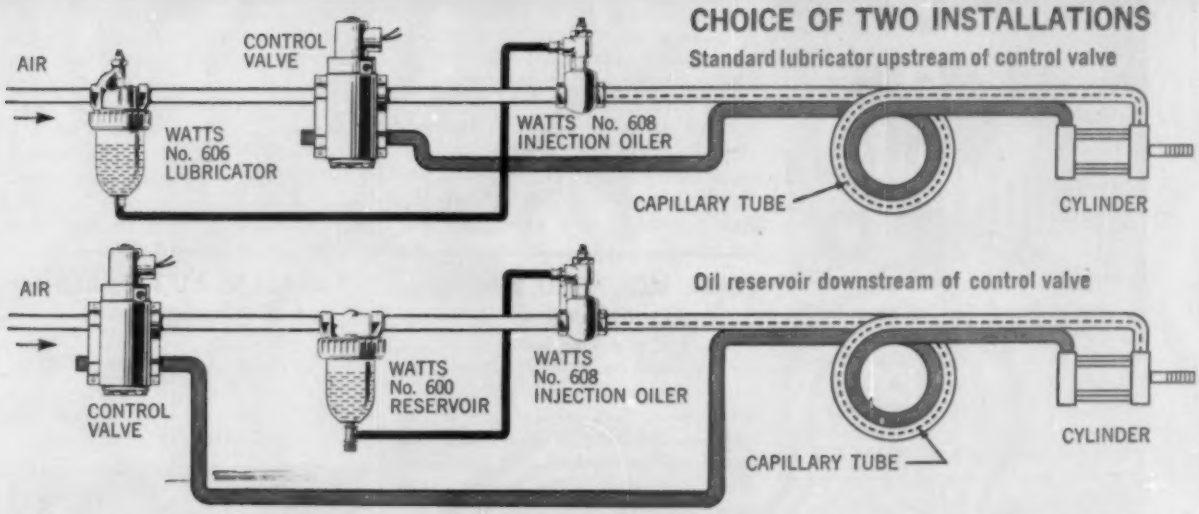
WATTS No. 608

1/4"-3/8"

AIR CYLINDER INJECTION OILER

Solves the problem of lubricating low volume, short stroke cylinders

CHOICE OF TWO INSTALLATIONS



Most low volume, short stroke air cylinders are impossible to lubricate properly by ordinary mist-type lubrication because of their low air consumption.

The solution is *controlled* oiling—*direct to the cylinder.* It's the *only* way to assure positive lubrication for long cylinder life.

Installed in the pressure line between control valve and air cylinder, Watts' new No. 608 Injection Oiler is designed specifically to deliver metered oil direct to the cylinder through a capillary tube located within the cylinder air supply line.

Find out about the Watts Injection Oiler. Available in kit form (K608), includes No. 608 oiler, 2 ft. oil supply hose and 16 ft. capillary tubing.

Write *Watts Regulator Company, Industrial Division, Lawrence, Massachusetts.*

FILTERS
REGULATORS
LUBRICATORS

YOUR SAFE SPECIFICATION

WATTS

For more facts circle 585 on Reply Card

PLANT ENGINEERING EQUIPMENT

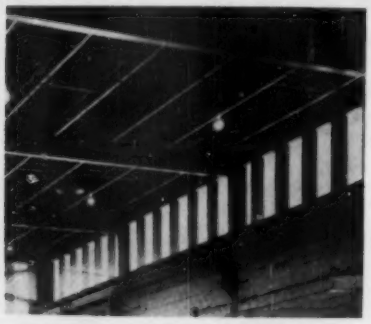
(Begins on page 186)

Available for 115 or 230 v, the Size 00 units are single, two or three phase with ratings from 1/3 to 2 hp. General Electric Co.

For details, circle 6 on Post Card

CURTAIN-WALL PANEL is insulating, translucent

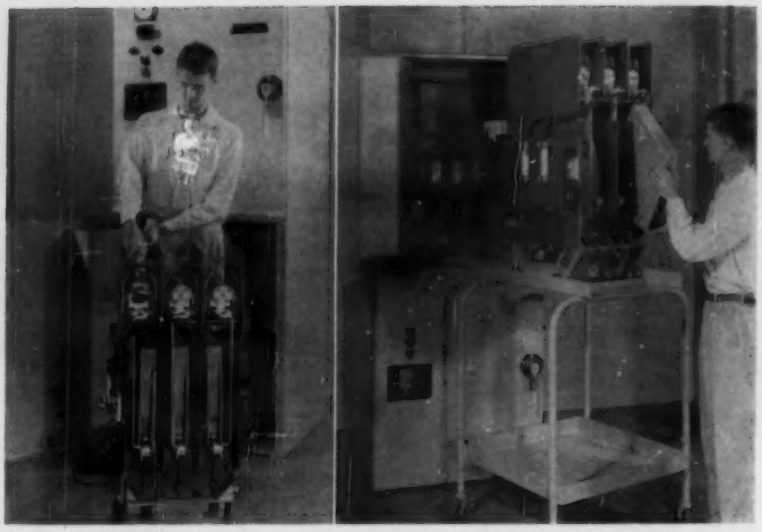
Condo-Lux is a prefabricated, translucent, insulating curtain-wall panel for use in conjunction with and interchangeably with Condo-wall, a metal insulating panel, as illustrated. Condo-Lux panels are said to provide U-factors from 0.19 to 0.26—about twice the effective insulation of double glazed sash. In-place cost is as little as $2.75 per square foot. Panels consist of fiber glass reinforced skins with an air insulating core. They come in 2- to 4-



in. thicknesses, 4 to 12 ft long and 32 in. wide. Fluted ribs in the exterior skins are on 4½-in. centers; V-type interior ribs are spaced to match exterior ribs. Fiber glass boards of 10½-lb density are used as structural shear members between skins. These boards are continuously bonded to the inner surfaces of the skins at the ribs.

The double diffusion of light through Condo-lux provides the equivalent of north light with a glowing softness on all exposures, says company, and the panels are light and inexpensive to ship and install. Installation is with hand tools using a pre-engineered system of flashing and joint covers which allows vertical and lateral adjustment. Condo-lux is adaptable to all types of building framing, as an entire wall or above masonry, and comes in a variety of colors. Dresser-Ideco Co.

For details, circle 7 on Post Card



HIGH VOLTAGE CONTROL features compact, two-high design

Half the size of company's previous models, and lighter, yet with same rating and capacity, the Space-Maker is announced as the first starter in the 2000- to 5000-v range with full drawout motor control and two-high design. Two full-voltage, high-capacity motor controllers, one above the other, fit space usually required for one controller. Each can have a full rating up to 1750 hp maximum at 2300 v or 3000 hp maximum at 4000-5000 v. Each has interrupting capacity of 150 mva at 2300 v or 250 mva at 4000-5000 v by use of current limiting fuses.

Heart of the equipment is the 400-amp, 5kv, 50-mva Type 456 air contactor with glass polyester Super Pyro-Shield insulation. Its use greatly reduces contactor size which, in turn, holds the two-high cabinet size to 36 in. wide, 32 in. deep and 90 in. high. One 45-in. high unit comprises a full voltage cage starter. The drawout feature consists of a wheeled carriage holding contactor, main fuses in their supports, main disconnecting fingers, control transformers and control transformer fuses, and test circuit switch. A racking mechanism lets operator move contactor carriage from operating to disconneting position. A wheeled dolly is provided for receiving the upper contactor when drawn out. Overload relays, visible with the door closed, are reset by buttons on the front door. Door cannot be opened until contactor carriage is in racked out position. Allis-Chalmers Mfg. Co.

For details, circle 9 on Post Card

WALL MOUNTED chlorinator of simplified design

Feature of the 3600 Series Chlorinator is the safety stack regulator within which all control components are housed. This reduces frail piping and connections — potential leak sources. The design also incorporates a shut-off valve, sealing the chlorine supply from the chlorinator during inoperative periods; an isolating valve which serves to seal tight the functional parts of the safety stack; and a differential pressure regulator to maintain stable chlorine gas feed. The manually operated unit is designed to maintain an accuracy of ±2 per cent of feed rate over a 20-to-1 range in flow. A snap-in flowmeter tube allows capacity changes from 3 to 200 lb of chlorine gas per day, without use of tools. Fischer & Porter Co.

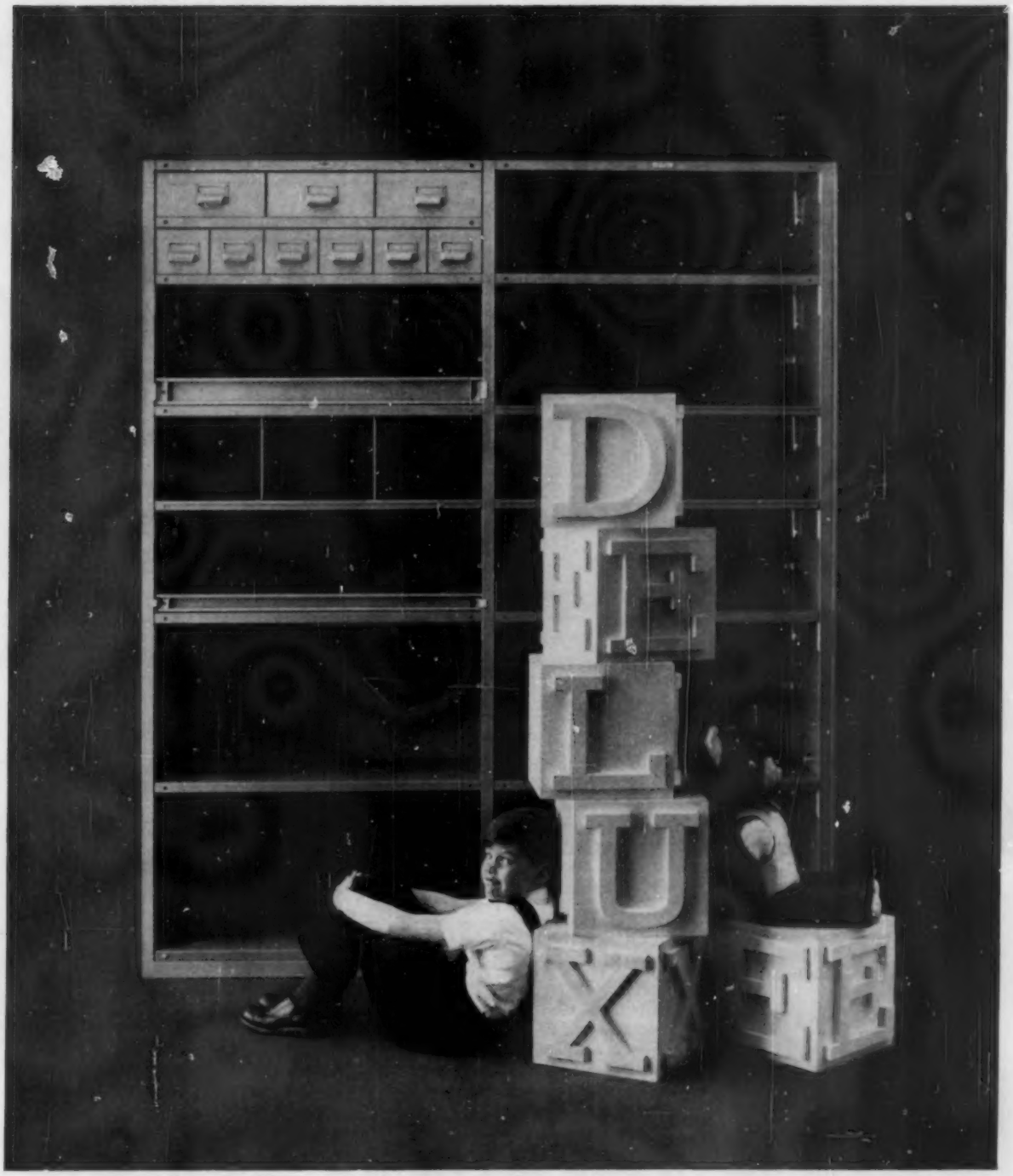
For details, circle 8 on Post Card

HYDRAULIC LIFT TABLE for handling heavy dies

This 20,000-lb capacity lift table for moving heavy dies on and off press beds is 4 ft by 10 ft in dimension. Wheel equipment has a polyurethane tread and all four wheels are

casters for convenient positioning. Table raises from a 30-in. lowered height to a 42-in. raised height. A 1-hp gear motor powers the double-

For more facts circle 585 on Reply Card



Boltless brackets give complete adjustability.

BUILD DELUXE SHELVING SECTIONS FASTER, EASIER!

Only DeLuxe steel shelving by Royal gives you all these advantages: Fast 15-minute assembly of sections. Patented boltless construction for easy installation, without tools. I-beam uprights for strong support. Double-thick steel end panels; rigid box-lid shelves; factory embedded shelf reinforcing returned on ends; greater shelf adjustment, 2" or 1"; wide choice of shelf units, bins, doors, drawers, dividers, in sizes and strengths you need. Smooth DeLuxe finish is baked on over Chem-a-Cote® bonding for lasting looks and wear. You can't beat it, buy it! Call or write DeLuxe Metal Products Division, ROYAL METAL MANUFACTURING COMPANY, DEPT. 69-L, One Park Avenue, New York City 16, N. Y.

DELUXE

For more facts circle 586 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

drum winch that transfers dies from table to press and vice-versa. A double countershaft connects the two drums, each of which has its own cable, two snatch blocks and a hook. West Bend Equipment Corp.

For details, circle 10 on Post Card

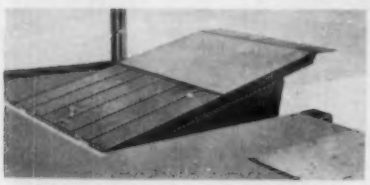
PORTABLE SALAMANDER for temporary heat requirements

Little Giant is a gas-burning portable salamander designed to provide heat quickly to areas requiring temporary heat, for drying and thawing, or for emergency heating. With a reported capacity of 50,000 Btu (85,000 to 100,000 upon request), the salamander radiates, circulates and spreads heat over a wide area by means of heat equalizing baffle and distributor shield. It burns L-P gas, butane or propane, has instant lighting, and automatic gas supply shut-off in case of flame failure. Hauck Mfg. Co.

For details, circle 11 on Post Card

DOCK LEVELER provides four-way action

This "four-way" dock leveler not only raises and lowers but also extends and retracts, providing what the maker describes as "dimensional" action. Platform consists of rear section which



is hinged to an embedded channel in the recessed loading dock and has five slots or runners, and a forward section which is extensible or retractable and operates in runners of rear section. Two hydraulic power supplies operate the leveler. Low space consumption and more flexible use in restricted areas are chief advantages claimed. When platform is level with dock floor and even with dock face it supports normal cross traffic up to 10 tons. The Wayne Pump Co.

For details, circle 12 on Post Card

RUBBER COVERED DOOR takes fork truck punishment

Completely rubber-armored to withstand the impact of fork-lift trucks as they pass through, extra heavy-duty Ace Duradors have a core of tough but light fiber glass, 3/16 in. thick. The door edge is protected by 1/4-in. soft rubber. An all-rubber hinge, extending the full length of the door, absorbs shock

without damage because it "rolls with the punch," manufacturer points out. Doors come fitted with clear Lucite windows. Also available is a heavy-duty Ace Durador with a core of 3/8-in. marine plywood. Both types have the bonded soft rubber armor 1/4 in. thick over the bottom half (protection against truck forks) and 1/8 in. thick over the top half. It is pointed out that because they are sheathed in rubber, Ace Duradors are well suited for chemical plants and plating and pickling areas where corrosive fumes may be a problem. American Hard Rubber Co., Div., Amerace Corp.

For details, circle 13 on Post Card

CLOCK AND SPEAKER combined in single panel

These clock-speaker combinations are engineered for integration with centrally controlled time, program signal, music or communication systems. The units combine a clock and speaker companion-mounted in a common panel, and have round or square dial components. The Standard Electric Time Co.

For details, circle 14 on Post Card

EPOXY RESIN COATING for interior finishes

Epo Liquid Regular Coating is an epoxy resin formulated as a permanent interior finish for walls, ceilings and structural metal. It is said to cure to a high permanent gloss comparable in appearance and durability to ceramic tile. Applied by brush, roller or spray, it adheres to wood, plaster, brick, concrete, block, drywall, or metal. It is described as nontoxic, impervious to soaps and detergents, with high chemical and abrasion resistance, making it suitable for use on machinery, tanks where severe chemical conditions exist, and for floor strippings. George E. Fines, Inc.

For details, circle 15 on Post Card

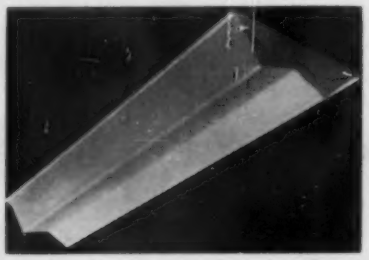
SENSING DEVICE detects, controls process variables

This sensing device employs the W-I-T (wire in tube) element for transmitting motion through a pressure-tight wall without bellows, seals or stuffing boxes. The element consists of a flexible, curved tube containing a spring wire. Deflection of the end of the tube by a change in level, flow or other variable causes a rotation of the wire, which in turn may indicate the change or operate a switch. The compact element may be used to indicate or control critical levels in boilers, heaters and similar pressure vessels, and to control flows. It can actuate alarms, cut off fuel supplies, start and stop pumps. Yarnall-Waring Co.

For details, circle 16 on Post Card

FLUORESCENT FIXTURE has polystyrene diffuser

This low profile fixture with a one-piece polystyrene diffuser and mounting two 40 w rapid start lamps is



designed to give economical, glareless illumination. Seamless sealed construction keeps out dust and dirt, thus minimizing light loss. Diffuser is hinged from either side without aid of tools, providing accessibility for installation or service. It is 3½ in. deep, 12 in. wide, 4 ft long. Modern Light Co.

For details, circle 17 on Post Card

TEMPERATURE-CONTROL uses photocell sensing element

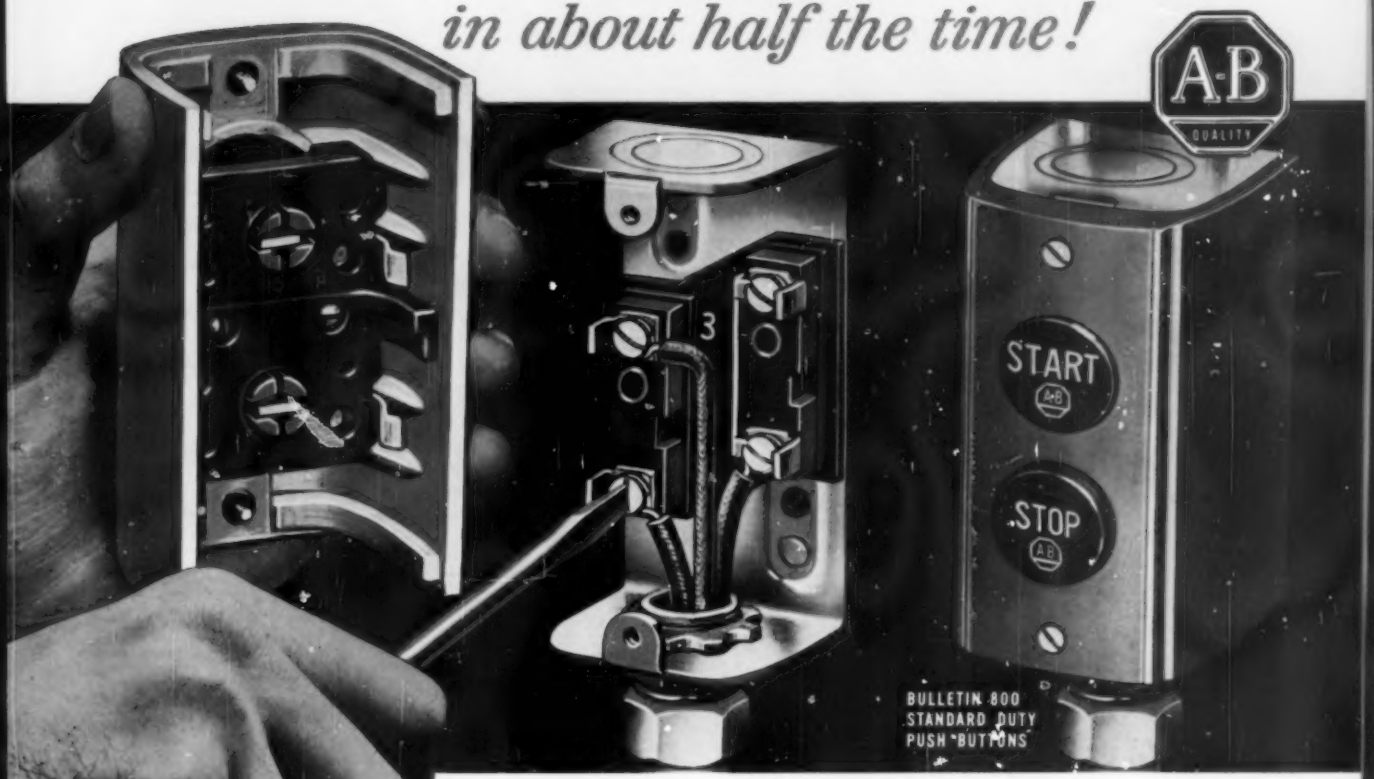
Bulletin 5108 PyroTemp is a temperature-limiting device for controlling industrial heating processes. Unit is designed to control temperature of moving parts or continuous strip, count-heated workpieces, automatic quenching, and induction or

For more facts circle 587 on Reply Card——►

ACTUAL TESTS* PROVE

Allen-Bradley Standard Duty Push Buttons can be installed

in about half the time!



In accurately timed tests, Allen-Bradley standard duty push buttons required *about half the installation time*—on the average—than each of four other popular makes. This saving in installation time means "dollars" saved on the job.

How come only famous A-B standard duty push buttons possess this time and moneysaving advantage?

The answer lies in the molded, wrap-around cover—which also contains the contacts. When the cover is removed, the wiring terminals are *out in the open*—ready for wiring—and you have plenty of working space. The two cover screws are captive—they cannot fall out and get lost. And with the contacts in the cover, they are protected against accidental damage and careless wiring. Naturally, these push buttons have double break, silver contacts that never need service attention. There are two concentric knockouts on each end of the base, which are removed from the *outside*—the heavy, pressed steel base will not bend out of shape.

Your local A-B distributor has these Bulletin 800 push buttons *in stock*. Call him today—you'll save time and money on your next job.

**Using recognized standard duty push buttons, installations were made by an experienced electrician under identical conditions. He was not connected with Allen-Bradley Company in any manner.*

A-B STANDARD DUTY PUSH BUTTONS
Made as a one-, two-, or three-unit station—with pilot light available. Readily changed for horizontal or vertical mounting. Convertible two- or three-way selector switch supplied with or without pilot light.

20-60-M

ALLEN-BRADLEY

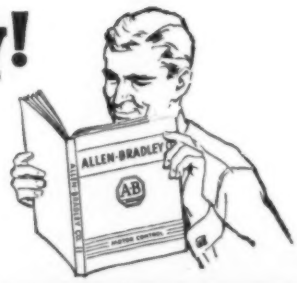
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

QUALITY MOTOR CONTROL

Some more special controls that are "standard" with Allen-Bradley!

Even Khrushchev couldn't claim a more complete line!



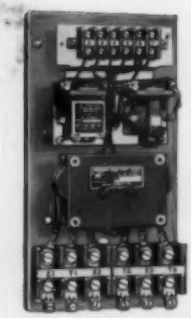
A-B QUALITY

Phase Failure Phase Reversal Relays

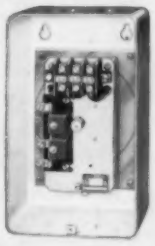
The Bulletin 812 Style RF relay responds to *all* open phase conditions on a branch motor circuit and immediately removes the motor from the line. Also, the motor is disconnected when a phase reversal occurs anywhere in the system on the line side of the relay. "Fail safe" design.

Phase Failure, Style F covers f.l. currents from 1.5 to 300 amp in 4 sizes. Coils to 600 v, 60 cycles.

Phase Reversal, Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycles.



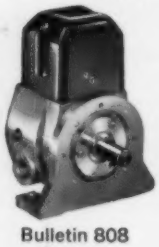
Bulletin 812 Style F



Bulletin 812 Style R

Zero Speed Switch

Used for "plugging" duty, these switches prevent coasting and bring squirrel cage motors to a sudden stop. Also used to prevent application of reverse power before motor comes to a full stop. Adjustable operating speed.



Bulletin 808

Low Pressure Switch

Especially designed for domestic water pump service and commercial air compressor service. These inexpensive compact switches offer pressure ranges from 15 to 200 psi.

Bulletin 830

Bulletin 803

Rotating Cam Limit Switches

Heavy-duty pilot controls used on rotating machines to initiate functions at any point of rotation. Made with up to 12 individually adjustable, independent circuits.

Bulletin 805

Foot Switches

Built for toughest service. Has maintenance free, snap-action contacts. Extended base prevents tipping. Made with hood (left), with top guard and without guard.

Bulletin 836 Style T

Pressure Controls

Oiltight enclosure for machine tool hydraulic systems operating at pressures up to 5000 psi. Operating pressure and differential are adjustable. Indicator shows trip point. Silver contacts never need service attention.

Bulletin 837 Style A

Temperature Controls

Newly designed bellows provides lower differentials. Rugged construction permits continuous cycling from zero to maximum setting. Vibration or mounting angle will not affect accuracy of operation. Temperature ranges from —150°F to 490°F.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

Member of NEMA

Quality Motor Control

29-60 M

PLANT ENGINEERING EQUIPMENT

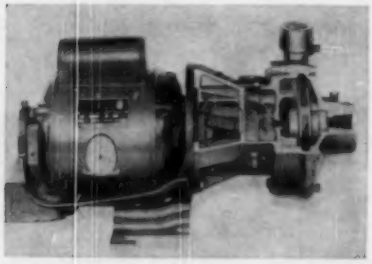
(Begins on page 186)

resistance heaters. No physical contact with workpiece is needed since it functions by measuring infra-red radiation. The pickup, with lead-sulphide photocell, is aimed at heated surface. An amplifier, temperature-selection dial, and output relay is housed in separate control unit. When temperature of heated workpiece exceeds that of pre-set level, the relay operates. Two models are available—Model PT-803 for use where minimum temperature to be controlled is 500 F or greater, and Model PT-801 for 1000 F or greater. The Clark Controller Co.

For details, circle 18 on Post Card

STAINLESS STEEL PUMPS compact, or long-coupled

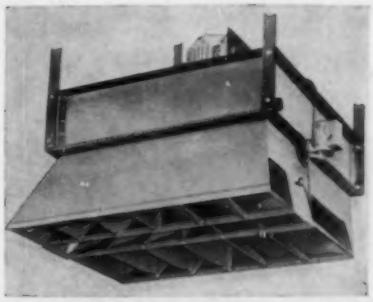
All wetted parts of these pumps are 316 stainless steel; seals are of Remite and are self-lubricating. The pumps come in two types: Series 1522, of compact Uni-built design; and Series 1512, of long-coupled construction. The former includes 36 models with suction and discharge connections from ¾-by-1¼ to 1½-



by-2 in. Quiet operation is a primary feature noted, since both pump and motor have long bronze sleeve bearings. These pumps are also supplied with a spring-type flexible coupling. Capacities of Series 1522 pumps range to 150 gpm, heads to 120 ft.

Pumps in the long-coupled construction series come in the same sizes, with capacities to 220 gpm, heads to 120 ft. These have deep grooved ball bearings and standard flexible couplings. More information is in Bulletins IG-1056 and CF-954A. Bell & Gossett Co.

For details, circle 19 on Post Card



DOOR HEATERS with dual-purpose-discharge feature

Vari-Jets are designed to stop cold drafts through plant shipping doors when they are open, and supplement the plant heating system when doors are closed. According to manufacturer, this door heater automatically provides a high-velocity curtain of warm air when a door opens, to penetrate and temper in-rushing cold outside air. When the door closes a damper is automatically repositioned for discharge of warm air at normal velocity to provide either room or perimeter heating under room thermostat control. In summer, the fan may be operated without heat to promote air circulation. The heaters come in 10 sizes for mounting heights to 22 ft and floor area coverage up to 60-by-132 ft mounted for [illegible] heating, or 33-by-180 ft for perimeter heating. Steam or hot water may be used as heating medium. The dual-purpose-discharge unit is available for replacement of standard discharge sections on existing installations of company's door heaters. L. J. Wing Mfg. Co.

For details, circle 23 on Post Card

WIRE ROPE designed for flexibility, long service

7-Flex is made of seven strands instead of the conventional six or eight strands of most wire rope, and it is claimed to combine the best features of both six- and eight-strand designs. It has an independent wire rope core. With the extra flexibility and compactness of the seven strands, plus 16-2/3 per cent more wearing surface than six-strand rope, it is reported to have given surprising service in tests. Sizes now manufactured are ½ to 1⅛ in. Macwhyte Wire Rope Co.

For details, circle 20 on Post Card

POLE GUN for airless spray painting jobs

Available in 4, 6- and 8-ft lengths, this pole gun is designed for high walls and ceilings, and other jobs where work surface is hard to reach. Features include a 360-deg detachable swivel head, large handle and trigger for ease of handling, and convenient paint shut-off needle valve at tip. Binks Mfg. Co.

For details, circle 21 on Post Card

ALKALINE STRIPPER for resistant paint finishes

Oakite Stripper 150 is an alkaline-solvent compound for stripping acrylic, alkyd and other resistant paint finishes. Company says it has no flash point, contains no phenolics, is safe on steel and magnesium and inhibited against attack on aluminum, zinc, and brass. A wax seal on surface retards evaporation. Oakite Products, Inc.

For details, circle 22 on Post Card

BRIDGE BREAKER keeps stubborn materials moving

Series BB Bridge Breaker is designed to move hard to handle materials which have a tendency to bridge, cake and otherwise obstruct continuous flow through supply bins. Unit employs rapidly vibrating, expanded metal screens mounted inside bin parallel to walls. Vibrators mounted on outside bin walls transmit vibrating action to screen by means of shock mounted studs that pass through bin walls. This allows screens to vibrate without causing bin and other equipment to vibrate. Thayer Scale Corp.

For details, circle 24 on Post Card

MULTI-USE PUMP handles four materials at once

These pumps are designed for pumping glue, inks, acids and other liquids and gases up to 30 gph for each of four stations, in production operations and laboratories where small controlled quantities must be pumped economically. Materials handled are isolated from contact with pump parts, company says, so that no cleanup is required to change over to different liquids, gases or colors. Four different materials can be pumped at the same time and

HIGH PRESSURE ASBESTOS PACKING
ROTARY & CENTRIFUGAL PUMP PAC
LEATHER • METALLIC PACKI
INGS • HYDRAULIC
V-RINGS • U
MPRESSOR
BOILER G
FLAX PAC
E FRICTION
METAL FOIL
SHEET PACKIN
CRISS-CROSS BRAID • COPPER WIRE
AL • SPIRAL WOUND GASKETS • AIR-C
TEFLON JACKETED GASKETS • PNEUM
HIGH TEMPERATURE STEAM VALVE P
BEL-VEE V-RING PACKINGS • CHEMICA
WOVEN ASBEST OIL
GASOLINE PA CK
CAL SEALS N
AMMONIA S
• JUTE PA
RAMIE PA H
DUCK & RU ON
TEFLON STOCK RODS

If it's Mechanical Packing . . . BELMONT Has It

Always Available for Prompt Service through Convenient INDUSTRIAL DISTRIBUTORS

See Packing Section, Thomas Register or Conover-Mast Purchasing Directory for Distributor nearest you.

Better Buy BELMONT

THE BELMONT PACKING & RUBBER COMPANY • PHILADELPHIA 37, PA.

For more facts circle 589 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

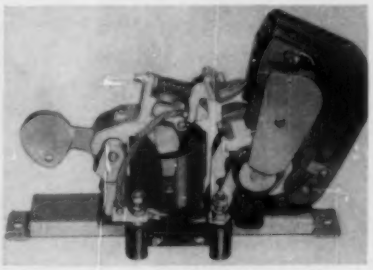
flow rate of each station can be controlled separately. Pumps afford a lift of 8 ft, and pump to 30 ft head. Custom Machine Co.

For details, circle 25 on Post Card

Use the Reader Service Cards provided on pages 227-228 to ask for more information on any of this equipment.

UNITIZED CONTACTORS offer mounting-wiring flexibility

Designed for use on heavy-duty mill controllers and integrated control systems, and other industrial applications, these unitized d-c contactors come in ratings of 100 and 150 amp. Unitized design allows greater mounting-wiring flexibility, company points out. Each contactor



is fixed on an insulated steel base which can be mounted directly on either steel or slate supporting panels, thus providing front wiring or rear-of-panel main wiring. A third wiring variation can be obtained by mounting contactor on a spacer, allowing control wiring to be channelled under contactor. Improved molded arc chutes and magnetic blowout structures for longer operating life, and interlock mounting brackets are other features announced. Cutler-Hammer, Inc.

For details, circle 26 on Post Card

REMOTE CONTROL VALVES automate piping systems

Automatic opening, closing and timing of pipe lines is made possible with these remote control valves designed for application on water conditioning systems, coolant systems, filtration plants, water works piping, lawn sprinkler systems, cooling towers, altitude valves, and food and chemical

For more facts circle 590 on Reply Card

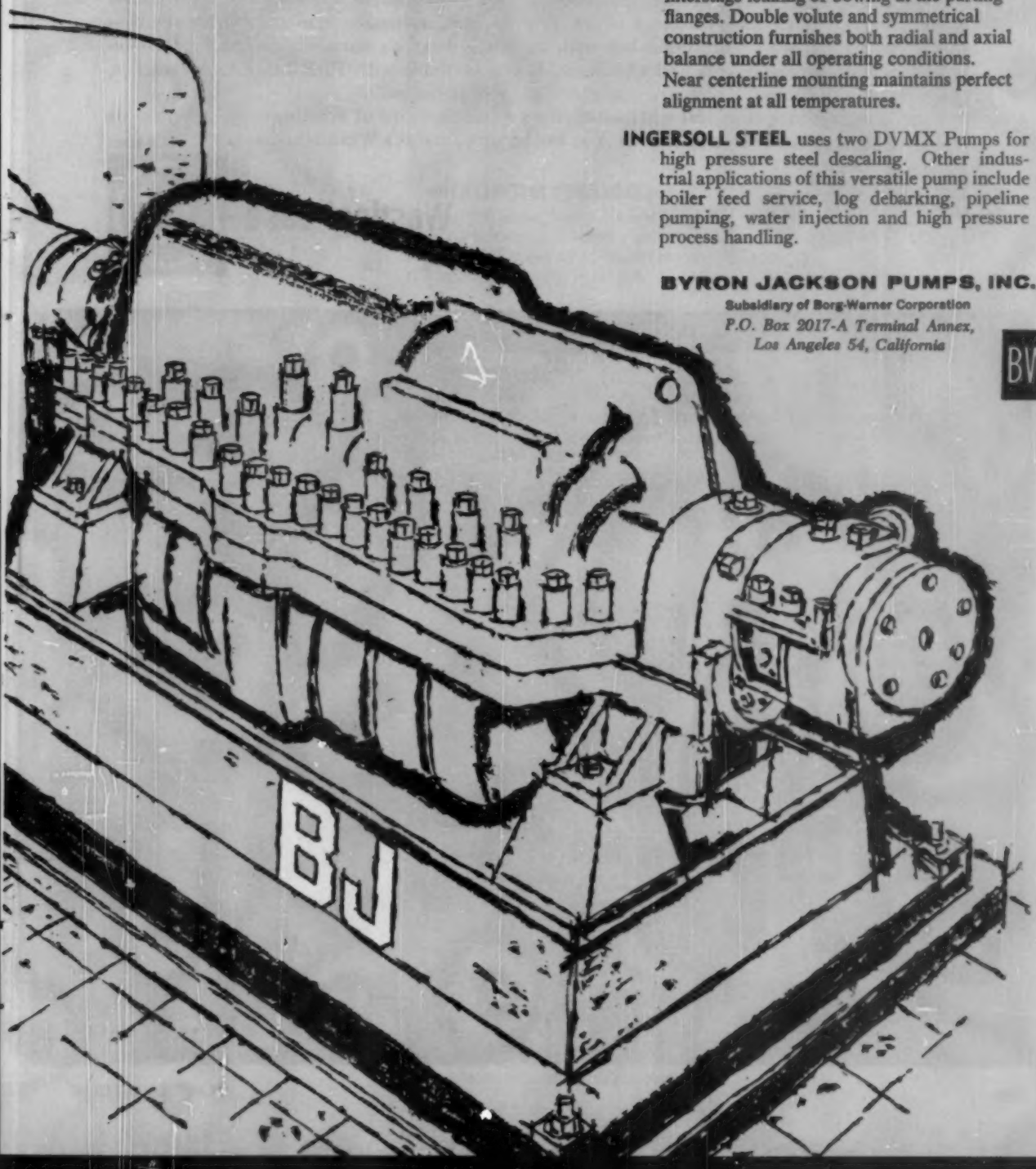
Quality *costs less* in the long run!

BJ High Pressure Pumps

For high pressure, high temperature and high speed pumping, an extra safety factor is built into this DVMX Pump—*the safety of a quality product!*

Clean and compact, BJ's advanced design allows double-row bolting to prevent interstage leaking or bowing at the parting flanges. Double volute and symmetrical construction furnishes both radial and axial balance under all operating conditions. Near centerline mounting maintains perfect alignment at all temperatures.

INGERSOLL STEEL uses two DVMX Pumps for high pressure steel descaling. Other industrial applications of this versatile pump include boiler feed service, log debarking, pipeline pumping, water injection and high pressure process handling.



BYRON JACKSON PUMPS, INC.
Subsidiary of Borg-Warner Corporation
P.O. Box 2017-A Terminal Annex, Los Angeles 54, California

BW

For more facts circle 590 on Reply Card

FAST SERVICE for panelboards and switchboards

For new construction or modernization of electrical service in older structures, Westinghouse can meet your needs from a line of panelboards and switchboards designed for every type and size of low-voltage distribution system.

Standardized components lower installed cost and eliminate special design and engineering time—yet each job is custom assembled to meet your code requirements. Eleven strategically located Westinghouse assembly plants, plus over 200 electrical wholesalers across the country, provide fast service on any job, anywhere in the U.S. Uniform high quality, and therefore dependable performance, is assured.

All Westinghouse circuit breaker panelboards and switchboards are equipped with famed Westinghouse AB De-ion® breakers which provide fast, automatic trip on short circuits—and a visual "tripped" indication—but with full time delay on harmless overloads. Fusible-type distribution panelboards and switchboards are available with FDP Life-Line® switches, quick-make, quick-break De-ion arc quenchers and visible blades.

Your Westinghouse electrical wholesaler offers a complete line of Westinghouse panelboards and switchboards for every application. You can be sure . . . if it's Westinghouse. J-93555

Westinghouse

BUILDING-TYPE DISTRIBUTION SWITCHBOARD Series 1

Compact design. Saves floor space. All components accessible from front. Service sections 25" to 29" deep with DB-type air circuit breakers or pressure-type fusible switches through 2000 amperes. Service and distribution sections 15" deep with AB-type circuit breakers through 800 amperes and FDP-type fusible switches through 600 amperes.

NLAB-LX LIGHTING PANELBOARD

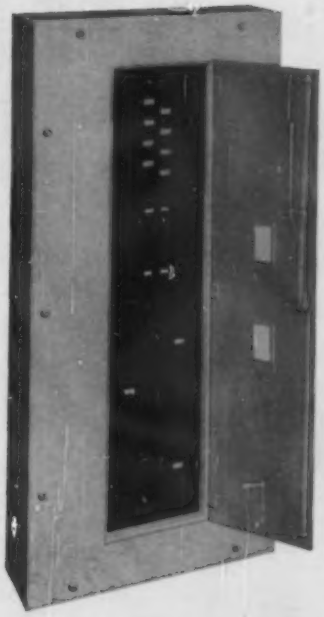
. . . to 200 amps, 240 volts a-c; 1, 2 and 3 poles. Quick-Flag® C type AB breakers in branches.

NPLAB LIGHTING PANELBOARD

. . . to 225 amps, 240 volts a-c; 1, 2 and 3 poles. Quicklag P (plug-in) AB breakers in branches, E and J frame main breakers. Handle extensions permit simultaneous manual operation of 2 single-pole breakers. Common trip handle on 2- and 3-pole units.

CDP CONVERTIBLE-TYPE DISTRIBUTION PANELBOARDS

. . . main breakers to 800 amps, main lugs to 1200 amps, 600 volts a-c, 250 volts d-c; 1, 2 and 3 poles. E, EH, F, J, JK, K, JKL, KL and LM frame AB breakers in branches.



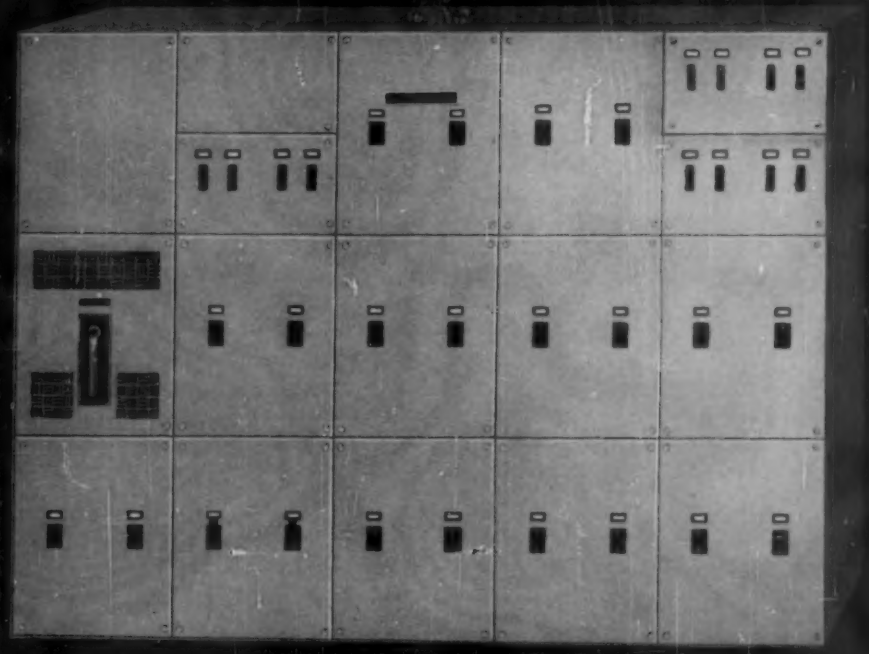
NA1B LIGHTING PANELBOARD

. . . to 225 amps, 240 volts a-c or 125/250 volts d-c; 1, 2 and 3 poles. E frame AB breakers in branches, E and J frame main breakers.

BUILDING-TYPE DISTRIBUTION SWITCHBOARD Series 2

Standardized switchboard design with main horizontal bussing from 600 through 4000 amperes. Standard depths 36" through 54". DB-type air circuit breakers or pressure-type fusible switches through 4000 amperes. AB-type circuit breakers through 800 amperes, Tri-pac* current limiting breakers through 600 amperes and FDP-type fusible switches through 600 amperes.

*Trade-Mark



For more facts circle 591 on Reply Card

New efficiency means you can now handle many mixing jobs with a smaller model drawing less power.
New shock-protected internal gear turns the mixer shaft at a slower, more powerful 350 rpm.
New super-pitch prop delivers up to 45% more fluid flow than previous LIGHTNIN gear-drive models . . . higher impeller head in direct-drive models.
ANNOUNCING

a new level of competence in the mixing of fluids

You get more work out of these all-new LIGHTNIN propeller-type mixers.

They'll handle bigger batches, heavier materials, or do the job faster —*without using more power.*

Often a smaller, lower-cost model will do the job you want done—*on less power than you've been using.* That's how efficient they are.

In normal use, you won't have to lubricate these mixers for five years. Overloads can't hurt the gear drive. The chemical plant motor is standard, at no extra cost.

Notice how we've moved the lower shaft bearing and chuck up out of the mixer base, away from the splash of tank contents. And you don't need three hands to change the shaft. New quick-acting chuck locks it tight when you turn one screw.

They're ready in eight sizes from ¼ to 3 hp, gear drive or direct drive. Ask your LIGHTNIN Mixer representative for details. His name is in Thomas' Register and in the yellow pages of your telephone directory. Or write us for descriptive Bulletin B-521.

FOR CLOSED TANKS. Same all-new design, with new stuffing box or rotary mechanical seal. Also described in Bulletin B-521.

PORTABLES, TOO. New indexing feature makes it a snap to set mixer at the correct angle. Nine sizes, ⅛ to 3 hp. Request Bulletin B-520.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 144-n Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 19, Ont.

For more facts circle 592 on Reply Card

PLANT ENGINEERING EQUIPMENT

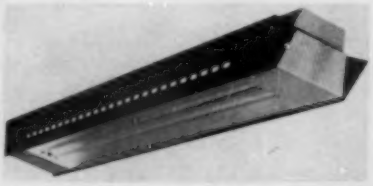
(Begins on page 186)

processes. Valves are rated for 150 psi water at 150 F and are available for 1- to 6-in. pipe. Model 1825 units incorporate a solenoid and are connected by wiring to timing device; Model 25 units are hydraulically actuated through plastic or copper tubing which links them with hydraulic controller. Both types close automatically in event of electrical or hydraulic power failure. Febco, Inc.

▲ For details, circle 27 on Post Card

ELECTRIC INFRARED UNITS for hard-to-heat areas

For overhead mounting, Series CH Heaters are suggested for outdoor heating, for indoor areas where only occasional heating is required, or for localized heating. They are also practical for supplemental heating since they

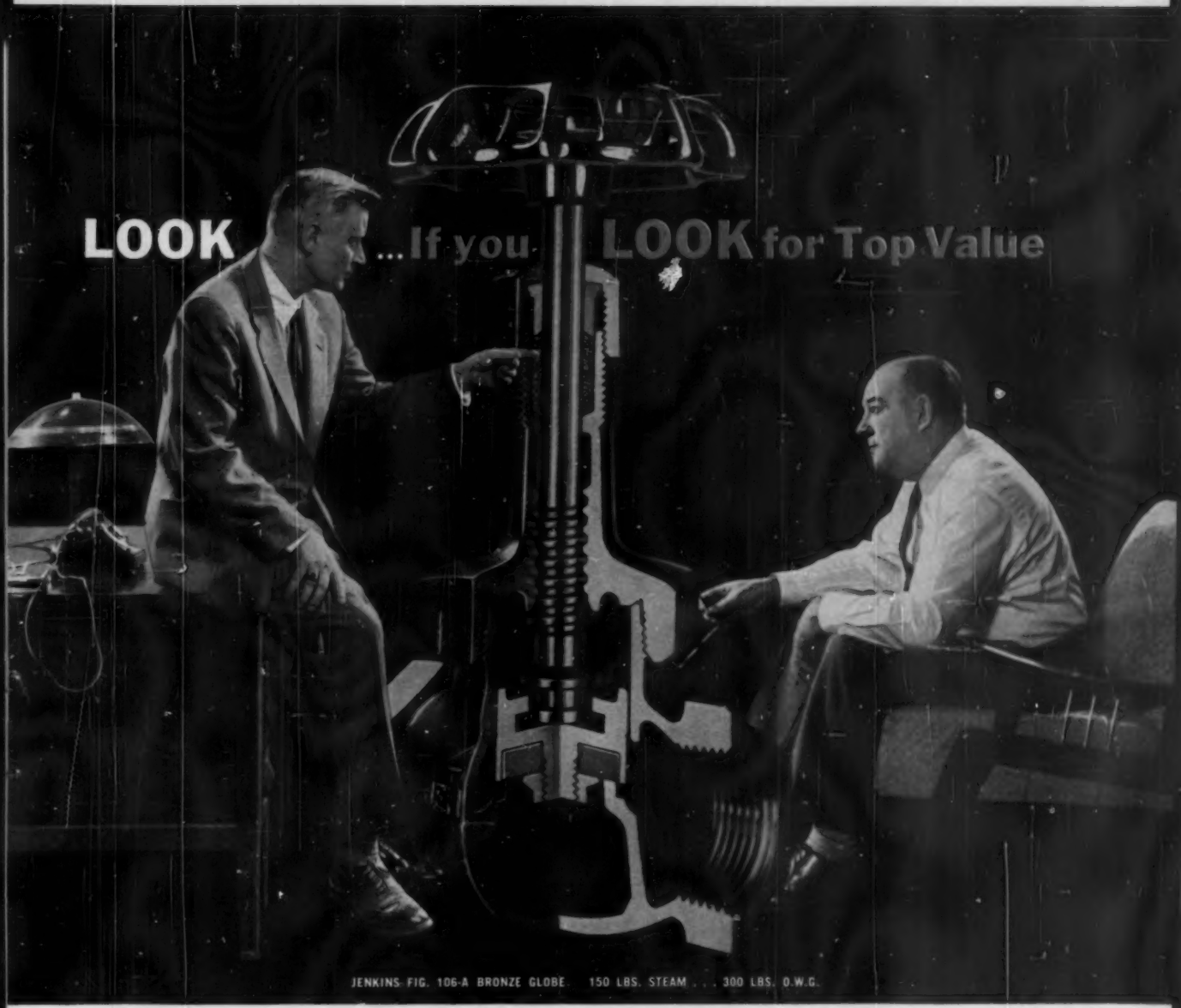


can be installed without disturbing walls or floors or modification of existing heating plant. These comfort heaters come in models for use with company's own linear quartz tubes or with standard high temperature T-3 linear quartz lamps, which provide high operating efficiencies. Conversion of up to 86 per cent of electrical energy into radiant output is claimed. Other advantages reported include low first cost, low operating and maintenance costs; silent heat without fumes or open flames; front loaded sockets for easy element installation. Bulletins CH-101 and CH-102 give data. Fostoria Corp.

▲ For details, circle 28 on Post Card

FILTER ELEMENT made of sintered stainless steel

Adaptable to any of company's Fulflo Filters, the CFC Porous Metal Element is designed for filtration of fluids with characteristics incompatible with ordinary filter media, particularly corrosive, high temperature and high viscosity fluids. It is available in uniform 40, 20, 10, 5 and 2 micron particle-retention ratings. The element is described as resistant to corrosion and high-temperature, free from media migration under high differential pres-



in Disc Equipped Bronze Valves

LOOK at that Wheel — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK at the Index Plate — Has Fig. No. etched in green background. Held by wheel nut which is secured by rolled-over spindle end.

LOOK at that Spindle — Made of high tensile bronze. See how much heavier it is . . . how more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK at the Packing Nut and Gland—Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK at that Packing Box — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK at that Bonnet — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK at the Disc Holder — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK at the Disc — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and **made by Jenkins**, the only maker of both valves and discs.

LOOK at that Body — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK at this . . . for Throttling

—Just replace the standard disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

THE FIRST renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS VALVES

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

For more facts circle 593 on Reply Card

"Rather primitive heating, what?"

There's no reason to get into a stew over heating problems when you can get all the facts about modern heating practice at the Heating & Air-Conditioning Exposition.

At the exposition you can obtain first-hand information and money-saving tips on new heating equipment as well as the latest developments in refrigeration, air conditioning, and ventilation equipment.

Over 500 fact-filled displays, staffed by top executives and key technical personnel, will provide you with information concerning more efficient methods of installation, maintenance techniques, use of related equipment, and anything they know from which you can profit.

Keep up with new developments for domestic, commercial and industrial applications. *Plan your visit now!*

15th International Heating & Air-Conditioning Exposition

Auspices ASHRAE

International Amphitheatre • Chicago, Illinois
Feb. 13-16, 1961

Management: INTERNATIONAL EXPOSITION COMPANY • 480 Lexington Ave., New York 17, N. Y.

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

sures, vibration or thermal shock, with high dirt-holding capacity, economic flow rates. It is cleanable by chemical or ultrasonic treatment or back flushing. Data in Bulletin S713. Commercial Filters Corp.

For details, circle 29 on Post Card

NAILING GUN drives 120 of them a minute

Newest addition to the Powasert line of high speed nailing equipment is this portable, single-blow automatic nailing gun designed to drive 120 nails per minute in sizes to 2½ in. long (8-penny) with heads to ⅜ in. diam. The gun can be used with older models of company's power feeder-separator unit, or automatic hopper. Common or machine grade nails are

dumped from bulk containers directly into the hopper, which aligns and feeds them, point-first and one at a time, through a flexible, transparent hose to the gun. The operator, depressing the safety-release lever, needs only to press the nose of the tool against the work surface, and the air-driven mechanism inserts a nail. Manufacturer says the gun cannot fire a nail unless pressed against a solid surface. Its power is adjustable for flush or countersunk driving. The gun weighs 9 lb, operates on 95 psi of air, consuming 20 cfm at top speed. It drives nails from any position. United Shoe Machinery Corp.

For details, circle 30 on Post Card

SMOKE RECORDER for new or existing boilers

This smoke recorder is described as a null-balance potentiometer with rapid traverse and adjustable sensitivity which may be set to cover a desired range of a smoke spectrum.

Air operates this folding machine to provide the neatly folded, factory-fresh shirts found in popular shirt stores. In the background, left, is an air- and steam-operated pressing machine that furnishes smoothly pressed shirts in seconds.

Compact 25S2 distributes air through 2-inch air-mains and laterals to individual machines. Mr. Hopper, (at right), expects "many years of trouble-free service from the Model 25S2 compressor."

Van Heusen "cuts operator fatigue– ups output per machine by 10% to 20%" with a

LE ROI 25-HP STATIONARY COMPRESSOR

Shirt-making is exacting work. It's so tiring that an operator's output can drop 40% in five hours. To reduce fatigue and to maintain efficiency, "we prefer air control for the more delicate operations of sewing and trimming machines, laundry, pressing and creasing work," reports Charles G. Hopper, assistant to the production manager of the Pottsville (Pa.) plant of Phillips-Van Heusen Corp.

At least some of the credit for reducing fatigue and increasing production is given to the 25 horsepower Le Roi compressor which provides air-power in their shirt factory.

The 105 cfm, 125 psi capacity of the Le Roi 25S2 air-cooled compressor more than meets current needs, and provides for the addition of more air-operated machines. Mr. Hopper states that the unit operates 10 hours a day, five and one-half days a week. To assure dependable air supply, valves of the 25S2 are inspected weekly, and oil is changed every 200 hours.

Why don't you check the benefits of pneumatic operation? Le Roi can meet your needs with Westinghouse unit-type and Le Roi stationary air compressors from ½ to 100 hp. See your Le Roi distributor for more information. Or write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

LE ROI STATIONARY COMPRESSORS

58-69

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

For more facts circle 595 on Reply Card

with
Faultless
Casters You Can Utilize Production Space
efficiently . . . and Change Plant Layout as Needed!

Today, your production line can move in a serpentine pattern

. . . tomorrow it can be changed to a straight-line or circular flow

A fluid Faultless Castered production line is quickly reshaped as needed . . . to suit new products, design changes, retooling, time-and-motion study recommendations, etc. Also Faultless Castered trucks, dollies, racks, carts can transport your manufactured products outdoors for yard stocking. Whatever your production line load requirements, floor surfaces, space limitations, Faultless engineers the precision casters to meet your specific requirements and limitations.

ASK YOUR DISTRIBUTOR: Your nearby Faultless Industrial Distributor maintains a substantial inventory of Faultless Casters for immediate delivery. He and one of the strategically located Faultless Sales Engineers are available to work with you on every handling problem in your plant. Or write for complete information.

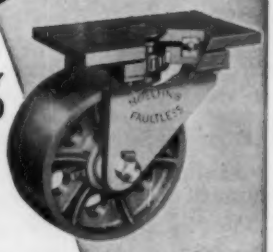
GENERAL DUTY SERIES 100 CASTER

LIGHT DUTY SERIES 400 CASTER

MEDIUM DUTY SERIES L900 CASTER

HEAVY DUTY SERIES H900 CASTER

EXTRA-HEAVY DUTY SERIES 1300 CASTER



NOELTING Faultless Casters

Faultless Caster Corp.

Evansville 7, Indiana

Branch Offices in principal cities; see the Yellow Pages of the telephone book under "Casters".

Canada: Stratford, Ontario

For more facts circle 596 on Reply Card

PLANT ENGINEERING EQUIPMENT

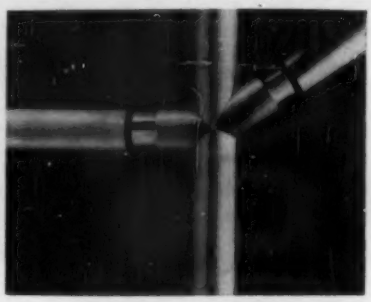
(Begins on page 186)

If complete coverage from clear to blackout is desired, this covers the entire chart graduated from 0-100. Also available are charts graduated from 0-100 with Ringelmann numbers. If more accurate readings of good combustion hazes are desired, optimum haze may be set at "50" on the chart with desired limits on either side. Bulletin 592 gives information. Photomation, Inc.

For details, circle 31 on Post Card

PIPE RAILING SYSTEM assembles without welds

Connectorail is a system of wrought aluminum fittings permitting economical construction of flush-type pipe railings, without welds or exposed fasten-



ers. Assembly is claimed easier and faster, and economy achieved through elimination of welding operations and use of lightweight Schedule 10 pipe. Components are available for all common conditions and stair angles. Complete system includes tees, elbows, floor and fascia flanges, connector sleeves, brackets, wall returns and plugs. Julius Blum & Co., Inc.

For details, circle 32 on Post Card

COMPUTER makes three computations on process variable

An analog computer designed to perform any one of three mathematical functions most common to process control is introduced for use with company's Autronic Systems. The computer, the C4A/2, can extract the square root of a single input or ratio or multiply two inputs from a primary transmitter. Its output signal is the analog value for the given mathematical function, and can be used to operate a recorder, indicator or controller. It permits use of electronic instrumentation for functions formerly requiring pneumatic sys-

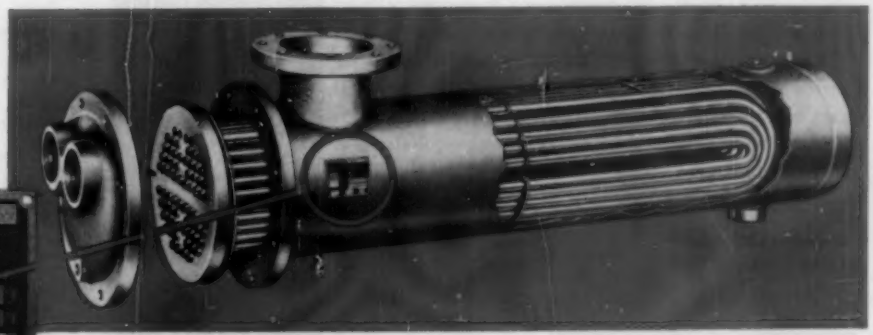
Heat exchangers stocked at B&G plant for serving rush orders

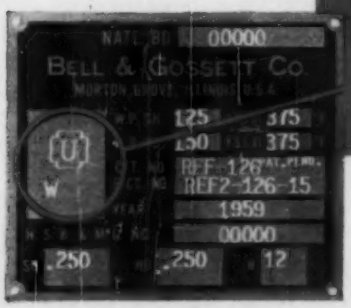
NEED A HEAT EXCHANGER IN A HURRY?

All facilities for heat exchanger manufacture are available under one roof at the B&G plant, where assembly line procedures permit building an inventory of stock parts and complete units. B&G Heat Exchangers are not only engineered to top efficiency but are constructed to the highest standards of quality and safety as required by the A.S.M.E. Unfired Pressure Vessel Code. Form U-1 Manufacturers' Data Report for Unfired Pressure Vessels is furnished with each unit as required by the provisions of the A.S.M.E. Code.

B&G Heat Exchangers are made in both U-bend and straight tube, floating tube sheet models. A comprehensive stock of U-bend exchangers is available for fast shipment. Refrigeration condensers, evaporators, liquid receivers and suction line heat exchangers are also maintained in factory stock.

Send for brochure "The A.S.M.E. Story"





All B&G Heat Exchangers are stamped with A.S.M.E. "U" Symbol

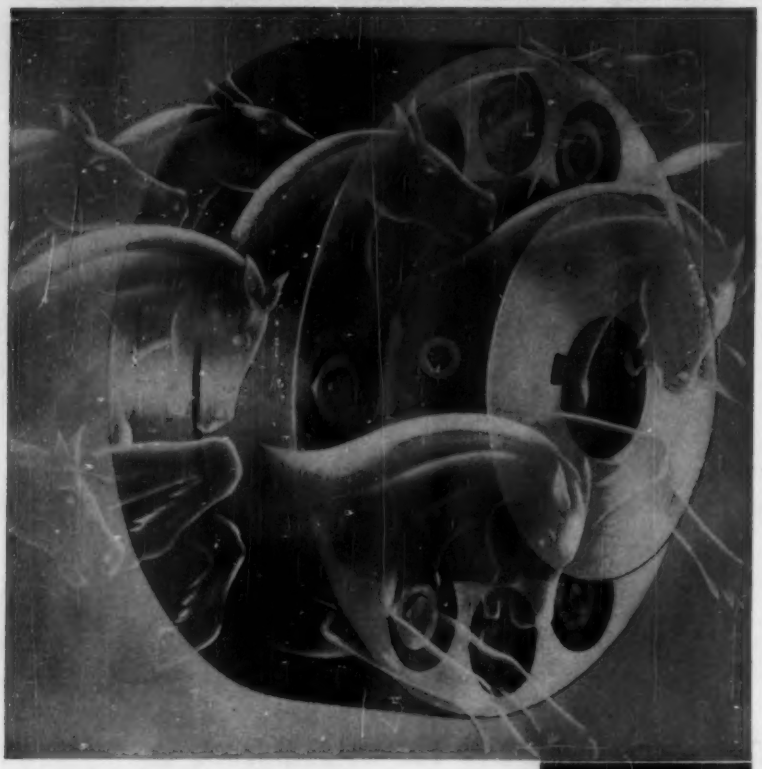
BELL & GOSSETT COMPANY

Dept. GL-53, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

For more facts circle 597 on Reply Card

ALL THE HORSEPOWER GOES THROUGH THE COUPLING

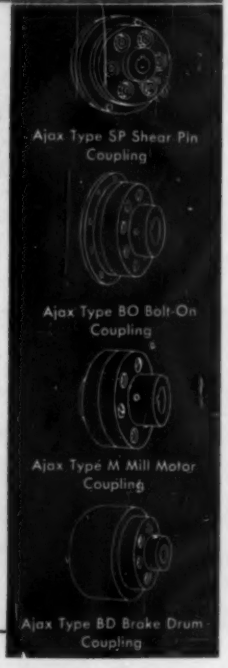


The Basic Reason Why it Pays to Use AJAX FLEXIBLE COUPLINGS!

For Original Equipment and Replacement... It costs far less to safeguard bearings, gears, impellers, armatures, housings, and other working parts than today's high cost of repairs and shutdowns!

Whether you design, build, install, operate or service direct-connected machines, look into all extra economies of AJAX FLEXIBLE COUPLINGS.

Made in a complete line of types and sizes,—phone or write for catalog.


Ajax Type SP Shear Pin Coupling
Ajax Type BO Bolt-On Coupling
Ajax Type M Mill Motor Coupling
Ajax Type BD Brake Drum Coupling

RUBBER-CUSHIONED SLEEVE BEARING TYPE

DIHEDRAL GEAR TYPE

AJAX

AJAX FLEXIBLE COUPLING CO. INC.
100 Portage Rd., Westfield, N. Y.
In Canada—The Alexander Fleck, Ltd., Ottawa

Send catalog covering Flexible Couplings.

Name_____
Concern_____
Address_____

For more facts circle 598 on Reply Card

PLANT ENGINEERING EQUIPMENT

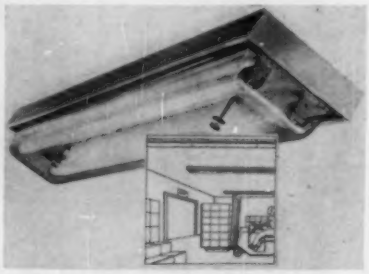
(Begins on page 186)

tems. Specification A-810 provides complete information. Swartwout Div., Crane Co.

▲ For details, circle 33 on Post Card

FLUORESCENT FIXTURE is dust, moisture resistant

Designed into the D.M.R. (dust and moisture resistant) Unit are features contributing to better performance where cleanliness is important and where it is desirable to protect lamps, electrical components and reflecting surfaces from dust, moisture and other foreign matter. The fixture has a



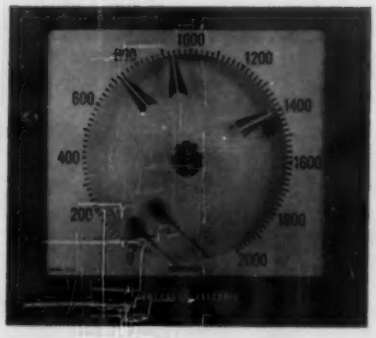
smooth top which permits mounting flush against the ceiling to prevent dust from accumulating on the top side. A one-piece plastic enclosure allows quick visual maintenance inspection, and smooth surface and rounded corners make cleaning easy. The entire lamp assembly is covered and gasketed. The fixture can be hosed down. Nothing gets to the lamp to cause breakage, manufacturer states, and lamps can't get loose and fall. The unit is a two-lamp, 4-ft model for individual or continuous mounting. It is available with clear or diffusing acrylic plastic enclosure. Company's "recipe" booklet gives some pre-planned layouts for DMR Units. The Miller Co.

▲ For details, circle 34 on Post Card

SEALANT now comes in 32 construction colors

PRC Rubber Calk, a polysulfide sealant, is now available in 32 colors. Sealants can be colored to complement, harmonize with, or match most popular colors used in construction, it is noted. Color hues available compare with recommended colors of the Porcelain Enamel Institute for curtain wall installation. The colored calk is suggested for use wherever colored metal or stone and masonry materials are used. Products Research Co.

▲ For details, circle 35 on Post Card



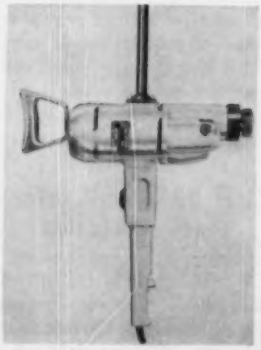
TWO-PEN RECORDER for two variables on one chart

This two-pen potentiometric round-chart recorder-controller is designed for nearly any application where two variables must be recorded on a single chart. Measurement circuits may be either potentiometric or bridge-type, or combination of both. Zener diodes offer a constant voltage reference accurate to ±0.05 per cent, company says, and temperature coefficient is 0.001 per cent per degree Centigrade. Minimum scale spans are 1 millivolt d-c. Pen speeds are 4, 10 and 24 sec full scale, and chart speeds are 1, 8, 12 or 24 hr; or 7 days. Adaptable for surface or semi-flush mounting, unit is 19 in. wide, 16 3/16 in. long, 15⅞ in. deep. General Electric Co.

For details, circle 36 on Post Card

HEAVY-DUTY DRILL is two-speed, reversible

To permit a variety of operations with one power unit, this 1¼-in. heavy-duty ball bearing drill has synchro-mesh transmission which changes spindle speed, even while the tool is operating,



from 500 to 250 rpm no load speed. This two-speed feature is useful in such operations as drilling holes from ½ to 1¼ in. Higher speed used with a smaller drill bit provides correct and practical speed for pilot holes, after which a larger bit is inserted and used at the lower speed. The drill also has a reversing switch with full power in either forward or reverse operation.

No. 6 in a series of washroom survey comments from "SBS soap counselors"

We showed them a money-saving approach to washroom maintenance!

James B. Workman, SBS Soap Counselor on the Eastern Seaboard, has helped many plants update their clean-up practices. Here's his account of a survey at a leading wire and cable manufacturing plant:

"The condition of the washrooms was not up to their desired standards . . . even though maintenance costs were much higher than they should have been. The culprits responsible were easy to pinpoint: a scrub soap, disinfectant, scouring powder and bowl cleaner—all of them slow-acting, one-purpose agents multiplying labor costs. Maintenance was using all 4 off and on . . . and getting nowhere.

"We approached the problem by demonstrating how much quicker SBS 50 will *clean, disinfect, sanitize* and *deodorize* fixtures, walls and floors in just one operation. This opened their eyes to SBS 50's effective 4-way action which eliminates duplication of labor, cuts housekeeping costs and creates a hygienic atmosphere employees respect and live up to."

Money-saving suggestions like this *begin* with OPERATION PINPOINT–a thought-provoking presentation filled with facts about skin hygiene and washroom maintenance. The SBS soap counselor serving your area can pinpoint the right soap to do every skin cleansing job best and at lowest cost in your plant. Let him show you OPERATION PINPOINT . . . just call your nearest SBS office, collect.

the washword of industry

SBS sugar beet products co.

SAGINAW, MICH. • Los Angeles, Calif. • Newark, N.J.
CANADA: Chemical By-Products, Ltd., Toronto, Ontario

For more facts circle 599 on Reply Card

At Bigelow-Sanford's Rocky River Mills . . .

CORROSION IS NO PROBLEM . . . WITH HAGAFILM®

One of four dryers handling entire production of plant. Corrosion maintenance on any one could cut production by 25%.

Quick case history: reading time 53 seconds

THE PLANT: Rocky River Mills, Bigelow-Sanford's high production carpet yarn mill, uses some 7½ million gallons of water and generates 4 million pounds steam per week for wool scouring, dyeing and drying.

THE PROBLEM: Rocky River, typical of South Carolina river waters, is never clear; it's loaded with iron, sometimes fertilizer, lignin and tannin. Process steam purity is critical since steam contacts the wool in dyeing and twist setting; and must not corrode equipment in scouring and drying operations.

THE SOLUTION: Hagafilm, a corrosion controlling filming amine, has been added to the plant's steam condensate system since the plant opened two years ago. This preventive maintenance has paid off . . . Joseph Jervis, Plant manager says, "We have had no corrosion downtime to date. Also, Hagafilm does not affect the dyestuffs when it contacts them in our dyeing operations; an important consideration in maintaining the high quality of our dyeing."

The plant reports minimum water problems because of intelligent preventive maintenance initiated since opening two years ago.

THE PRODUCT: Hagafilm is available in liquid and solid forms. It is easy to use and safe, even where contact steam is used. Hagafilm more than pays for itself in controlling corrosion, improving heat transfer, reducing maintenance and downtime. A complete description of Hagafilm is your for the asking. Write for Bulletin 410-12-7.

HAGAN
CHEMICALS & CONTROLS, INC.
HAGAN CENTER, PITTSBURGH 30, PA.

HAGAN DIVISIONS: CALGON CO. • HALL LABORATORIES • BRUNER CORP.
For more facts circle 600 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

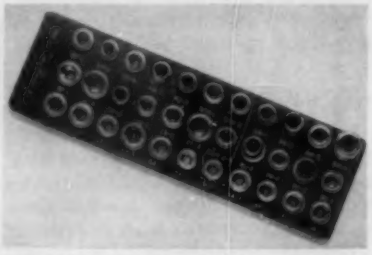
The tool can be used for operating speed reducers, hoists, elevators and similar operations. It has a heavy duty universal motor, extra length switch and pipe handles for control, automatic release trigger switch. Form 7 gives data. Black & Decker Mfg. Co.

For details, circle 37 on Post Card

It's easy to obtain product data with the postage-free Reader Service Cards provided on pages 227-228. Use them for information on advertised products, too. Just circle the key number appearing on bottom of the ad.

GAGE facilitates replacement of removable faucet seats

With this gage you can determine the size and type of removable faucet seat required to replace an ex-



isting worn or corroded one. Of anodized aluminum with engraved markings, the gage contains 33 tappings to permit gaging of seats found in popular makes and models of faucets. J. A. Sexauer Mfg. Co., Inc.

For details, circle 38 on Post Card

CIRCUIT BREAKERS offer high speed protection

Low-voltage, current-limiting K-Don Circuit Breakers are introduced for economical high-speed protection against fault currents up to 200,000 amp. These breakers integrate—in a single switchgear compartment—fast-acting, high capacity fault protection of company's Amptrap current limiting fuses with the protective features of its K-line stored-energy breakers, and a device that prevents single phasing, it is stated, and without sacrificing adjusting flexibility needed for overcurrent and medium-capacity short-

HERE'S ONE THAT WORKS...

every time—and for a long time

You'll never break your back trying to turn this valve. The plug seals securely in a Teflon® sleeve. It won't stick or freeze—even after months in one position. It's priced to replace ball valves, gate valves and lubricated plug valves wherever they are in use.

Available in ¼" through 6", 150 and 300 psi, straightway and 3 way. Alloys include carbon steel, 316 S.S., Durimet-20, Monel, Nickel, Chlorimet-2 and Chlorimet-3.

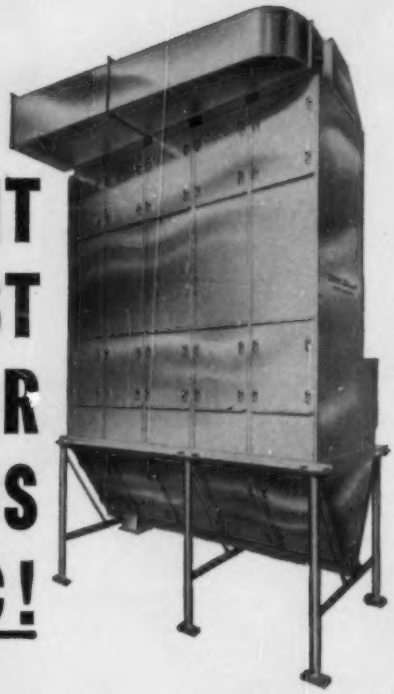
Write for your copy of Bulletin V/14.

DURCO
Serves the Process Industries

THE DURIRON COMPANY, INC., Dayton, Ohio / Valves • Pumps • Filters • Process Equipment

For more facts circle 601 on Reply Card

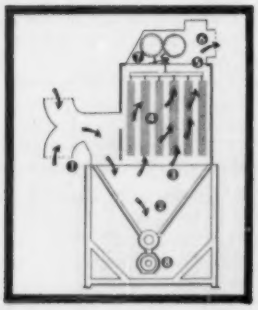
NEW TORIT DUST COLLECTOR IS AUTOMATIC!



Save real dollars with the benefits from this *automatic* dust collector. No more interruptions on production lines! Maintenance problems are practically eliminated. This all new continuously cycling TORIT dust collector *automatically* cleans your air and *automatically* shakes its own filters and blows them clean with reverse air flow. Collected material is emptied *automatically*.

OTHER EXCLUSIVE TORIT BENEFITS

- automatic filter-shaker mechanism is simple, maintenance-free
- different dusts may be collected separately
- highest air-to-cloth ratios (from 5 to 25:1) and longer filter life
- only ¾ H.P. required for fully automatic operation
- polished ¾" aluminum construction for minimum floor loading
- modular design—5' wide x 4'-8" long (for two sections) x 15'-6" high—saves space, lends ease and versatility to installation. Use up to 12 modular sections for each application! No limit to CFM capacity!



AUTOMATIC AND EFFICIENT, the filtering cycle of each TORIT section is self-timing. A separate blower on the clean air side keeps collector under suction. Then, (1) dust-laden air is taken into manifold; (2) coarse dust drops out; (3) fine dust is carried to filtering sections; (4) filter tubes catch dust on inside surfaces; (5) clean air emerges from filters; (6) to suction fan and clean air discharge outlet. (7) *Automatic* shaking and reverse air filter cleaning mechanism. (8) Conveyor *automatically* removes and discharges accumulated dust.

Have a cleaner plant, better morale and high productivity with lowest maintenance costs. Special design services are available based on your individual requirements. Write today for literature.

TORIT MANUFACTURING COMPANY

Automatic Collector Division, 1133 Rankin St., St. Paul 16, Minn., Dept. 1834

For more facts circle 602 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

circuit tripping. They provide fault protection for the system, the breaker itself, load-side equipment, and operating personnel.

Among application possibilities are replacement of existing breakers where available short circuits, due to system expansion, exceed breaker interrupting capacity; protection of panelboards with limited interrupting capacity; and protection of low-voltage bus duct, and other load-side equipment with limited short-circuit withstand capacity. I-T-E Circuit Breaker Co.

For details, circle 39 on Post Card

PORCELAIN PIPE for high pressures, temperatures

Pipe and fittings are available in Steel-clad Porcelain for services to 150 psig and 400 F. Manufacturer says they combine chemical and heat resistance of porcelain with mechanical protection of steel shells. Armor consists of

10-16 gage steel tubing fitted and cemented at extremeties of chemical porcelain pipe or fittings. Stainless steel expansion ring is incorporated in straight pipe lengths to overcome differential expansion of porcelain and steel at high temperatures. Fully rotatable steel flanges are shouldered to steel shells and can be pulled up more firmly and gasketed joints held tighter, company says, than in other types of porcelain piping. Pipe is available in ½ to 8 in. Lapp Insulator Co.

For details, circle 40 on Post Card

VALVED COUPLER eliminates disconnect spray

Spray occurring when connecting or disconnecting a valved coupler-plain nipple combination is claimed eliminated with the ES Series coupler. It utilizes a positive metal-to-metal stop when valve is in closed position, controlling compression and displacement of valve seal. An extra O-ring seal in the coupler is designed to prevent spray when there is internal pressure on one side of coupling. Two types are available—

For more facts circle 603 on Reply Card

View of the snack bar and lounge in the Bell Telephone Company's new office building in Pittsburgh, Pa. A portion of the snack bar walls (foreground) shows the use of two colors of Natco Vitritile to create an interesting, colorful pattern. The lounge wall (background) shows the beautiful effect achieved through the use of Natco roman brick with Wave-Tex finish.

Another modern "showplace" through creative use of Natco Products

The 1,600 employees in the Bell Telephone Company's brand new Pittsburgh office building can point with pride to their new lounge and snack bar. It's truly one of the interior "showplaces."

Two Natco products were used extensively to help create this modern center of color, texture and design: (1) Natco roman brick with Wave-Tex finish, and (2) Natco ceramic glazed Vitritile.

But modernity is only *one* of the important qualities of Natco structural clay tile building products. They're also the most *functional* building products available. Take Vitritile, for example. Ceramic glazed Vitritile comes in a variety of pleasing, non-fading colors. It's easy to install and maintain. It's fireproof, sanitary and will *never* lose its "brand new" look.

All that's necessary to transform the highly functional qualities of Natco products into a modern showplace is *imagination*. Write for one of our new "full line" catalogs.

Vitritile comes in three nominal face sizes: 8" x 16", 5⅓" x 12" and 5⅓" x 8", in 2", 4", 6" and 8" thicknesses.

Today's idea becomes tomorrow's showplace . . . when Natco structural clay products are in the picture

natco corporation

GENERAL OFFICES: 327 Fifth Avenue, Pittsburgh 22, Pennsylvania . . . Branch Offices: Boston • Chicago • Detroit • Houston • New York • Philadelphia • Pittsburgh • Syracuse Birmingham, Alabama • Brazil, Indiana . . . IN CANADA: Natco Clay Products Limited, Toronto

PLANT ENGINEERING EQUIPMENT

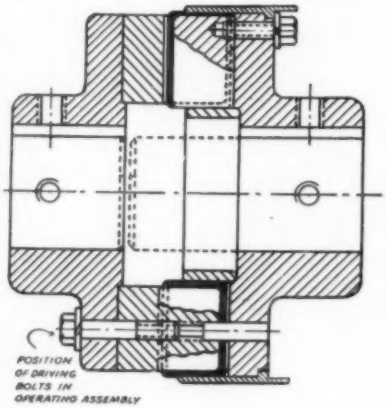
(Begins on page 186)

with nipple and coupler valved for double shut-off or with valved coupler and plain nipple for single shut-off. Sizes are from ¼ to 6 in. with choice of seals for handling various materials. Snap-Tite, Inc.

▲ For details, circle 41 on Post Card

FLEXIBLE COUPLINGS allow rotation or radial removal

Standard-duty (Type CQ) flexible couplings incorporate one set of jaws in removable ring form, permitting both independent rotation or radial removal of connected machinery. This feature is advantageous on gasoline, steam or diesel engine applications where driven machinery

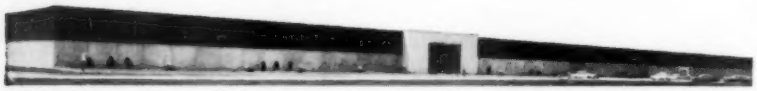


must be disconnected in order to set or time the engine. Pulling a removable jaw ring outward provides enough clearance for independent rotation of either end of coupling. By reversing a set of cap screws from one body to the other, connected machinery can be removed radially without disturbing power transmitting elements. Type CQ Couplings have maximum bores from 1⅜ to 5½ in., from 2.58 hp to 156 hp at 100 rpm; and Type HQ, 1¾ to 8½ in., 7.77 to 810 hp at 100 rpm. Lovejoy Flexible Coupling Co.

▲ For details, circle 42 on Post Card

PIPING FITTINGS of polypropylene plastic

Production of a limited size range of polypropylene plastic fittings for industrial piping—in 2- and 4-in. pipe sizes, Schedule 40 and Schedule 80 wall thickness—is announced. Recent perfection of Thermo-Seal homogeneous fusing has enhanced use of poly-



THE AIR IN THIS PLANT IS CLEANER THAN THE AIR A MILE ABOVE IT

The air in this plant has to be clean, because they make precision electronic parts here. It is the Collins Radio Company manufacturing plant in Cedar Rapids, Iowa . . . completely air-conditioned, and electronically air-cleaned with Westinghouse Precipitron®. Collins finds that clean, controlled air pays for itself in fewer rejects, more reliable products, and in reduced absenteeism. Write for our booklet describing the advanced air engineering concept Collins has adopted – based on Westinghouse air handling and air cleaning products. Dept. LE08, Sturtevant Division, Hyde Park 36, Massachusetts. YOU CAN BE SURE . . . IF IT'S **Westinghouse**

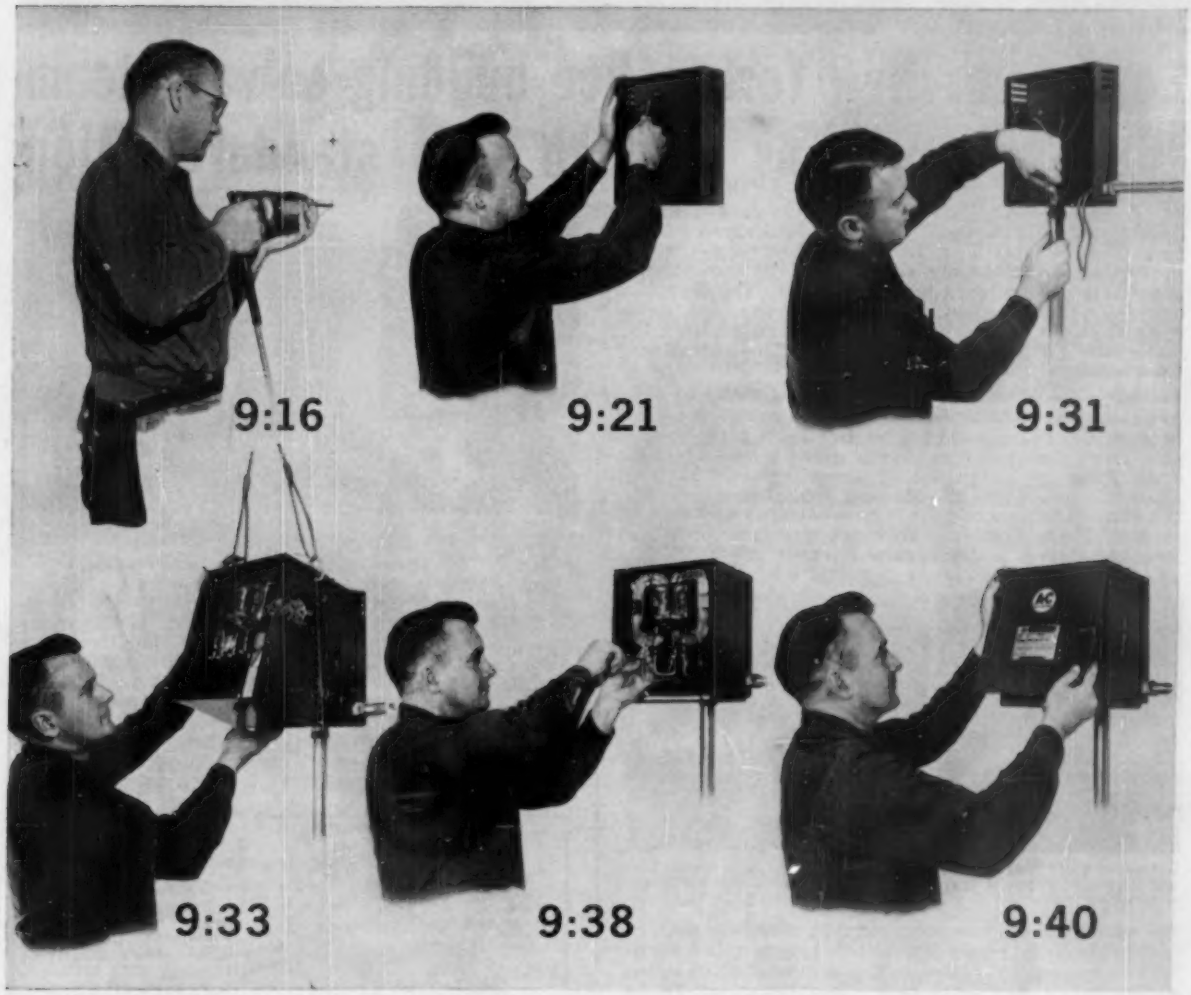
J-80708

For more facts circle 604 on Reply Card

Natco corporation
Boston • Chicago • Detroit • Houston • New York • Philadelphia • Pittsburgh • Syracuse
Birmingham, Alabama • Brazil, Indiana ... IN CANADA: Natco Clay Products Limited, Toronto

ALLIS-CHALMERS

A-1360



9:16 — 16 minutes to drill 4 holes in concrete wall and add lead inserts to receive screws. **9:21** — 5 minutes to mount back panel to wall. **9:31** — 10 minutes to punch out knockouts and attach conduit. **9:33** — 2 minutes to put center case section in place and tighten side screws. **9:38** — 5 minutes to pull cables and connect to terminals. **9:40** — 2 minutes to fasten front panel to center section with side screws. **Installing time: 40 minutes instead of the usual hour and a half!**

35% smaller, lighter, new whisper-quiet dry-type transformers

cut installing time in half!

New A-C design eliminates common installation problems! Unique 3-piece case makes handling, wiring go like clockwork. 35% smaller and lighter, you can install them in 40 minutes instead of the usual 90 minutes.

And they're whisper-quiet. Every known factor in subduing noise has been incorporated ... core impregnation, core and coil assembly suspension isolated from case ... plus use of nonresonate casing. Exclusive *Curvacore* construction lowers exciting current, core losses.

This new 600-volt class indoor dry-type transformer line is available in sizes 3 to 50 kva ... for on-the-site load center applications where critical voltage must be maintained.

See your nearby A-C office for details or contact **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

Curvacore is an Allis-Chalmers trademark.

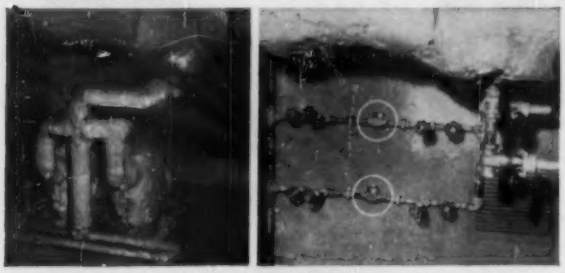
For more facts circle 605 on Reply Card

SARCO TOPICS

How Major New York office building solved steam trapping problems through trap standardization

Recently, the Office Building at 625 Madison Avenue, New York, — erected in 1931 and comprising 420,000 square feet on 17 floors — discontinued its own steam generation and switched to district steam. The changeover made the inadequacies of old bucket and float traps more apparent than ever, and afforded an occasion to modernize trapping. Here's how major improvements were made.

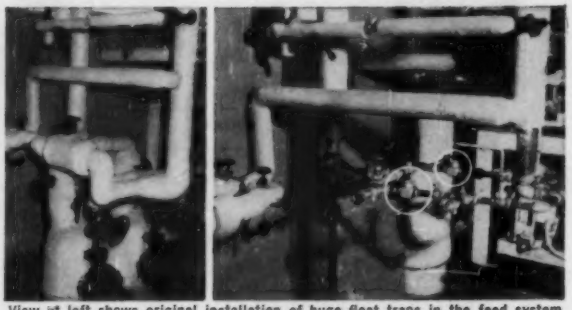
The first problem was maintenance. All maintenance had to be done at night or on weekends, at overtime rates, because the system could not be shut down during business hours. Frequent breakdowns added to maintenance costs. After the installation of Sarco Thermo-Dynamic Steam Traps, Type TD-50, trap maintenance — and therefore maintenance costs — have been reduced almost to zero. The engine room crew are now free for other jobs, and savings in both regular and overtime manhours are considerable.



Left picture shows the steam service main from the street, with massive float trap installation. Picture at the right is view of installation after the changeover to TD-50's (circled).

The second problem was water-hammer, caused by passage of live steam into return lines when traps failed open. (When traps failed closed, water accumulated in steam supply mains and equipment.) Installation of TD-50 steam traps ended waterhammer and consequent damage to equipment, because the TD-50 discharges condensate as rapidly as it is formed and prevents steam from entering the return system.

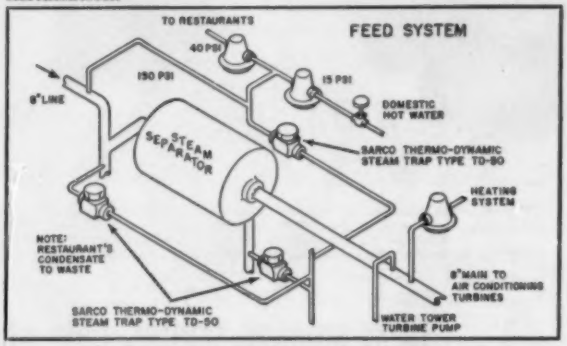
The third problem was live steam loss. Live steam, discharged into the return lines, not only represented a great waste of heat energy, but caused waterhammer in the return, and raised the condensate temperature to an excessive level. (Incidentally, although the building's district steam system is, of course, not faced with this problem, hot condensate passing through condensate pumps can damage pump seals.) These problems are eliminated through the use of TD-50's. No steam can be blown into the return main because the TD-50 shuts off *positively*, blocking any possibility of live steam being discharged into the return. Savings are considerable.



View at left shows original installation of huge float traps in the feed system of the building. View at the right shows compact installation of Sarco TD-50 Steam Traps (circled).

These benefits were achieved by replacing bucket and float traps with Sarco Thermo-Dynamic Steam Traps, Type TD-50, matched and correctly sized to the application. For example, many ½" bucket traps were replaced with ⅜" TD-50's, which have ample capacity for the job.

The TD-50's pressure range of 10-600 psi made it possible to standardize on one steam trap for a variety of applications that formerly required traps of many different types and pressure ratings. Finally, changeover took only 30 minutes per trap for each compact TD-50 installation.



Schematic hook-up of the converted feed system.

The success of this TD-50 installation led Collins, Tuttle Co., Inc., managers of the building, to substitute Sarco Thermo-Dynamic Steam Traps for competitive bucket traps in two other major New York buildings.

For more information on Sarco Thermo-Dynamic Steam Traps, contact your Sarco Sales Representative or district office, or write.

2165

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

For more facts circle 606 on Reply Card

SARCO

Here are 7 Sound Reasons Why the Thermo-Dynamic® Does a Better Job of Trapping

1. *Simplicity*—has only one moving part. 2. *Maintenance*—practically zero. 3. *Wide pressure range*—one trap for all pressures from 10 to 600 psi. 4. *Uniform performance*—operates equally well on heavy, light, or no condensate load. 5. *Operates against back pressures*—up to 50% of inlet pressure. 6. *Rugged*—unaffected by superheat, water hammer, vibration, or corrosive condensate. 7. *Minimizes inventory* of spare parts.

Maintenance Time: 40 Seconds. If it now takes your maintenance crew more than a couple of minutes to service an ordinary trap, you're throwing away valuable time. This Sarco Thermo-Dynamic can be cleaned, blown out if necessary, and reassembled on the line in as little as 40 seconds.

For Prompt Information on the TD-50 . . . or for fast help on the efficient solution of any steam trapping problems, get in touch with a SARCO District Office, Sales Representative, or Distributor. (There's one near you.)

Only SARCO makes all 5 types:

Thermo-Dynamic* • Thermostatic • Liquid Expansion • Float Thermostatic • Inverted Bucket

*U.S. Pat. No. 2,817,353 TM Reg. U.S. Pat. Off. 1409

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

propylene pipe and fittings, company says, for they can quickly be joined by heat sealing, making leakproof bond that is claimed stronger than pipe itself. Tube Turns Plastics, Inc.

For details, circle 43 on Post Card

HANDRAIL SYSTEM is economical, easy to install

Alurail, a contemporary aluminum handrail system, provides a complete installation with only three post designs. It accommodates any stair angle, says company, and can be erected on the site with hacksaw,

drill and small wrench. Field assembly is made possible with aluminum accessories. Bolt anchorage to walls and floors is concealed and no pipe threading or welding is required. According to manufacturer, the installed price of the system is competitive with that of welded iron pipe. Aluminum Railing Corp.

For details, circle 44 on Post Card

STEEL CANOPIES offer style, weather protection

These canopies have a weathertight roof of interlocking Armco Steelox panels, flat and smooth underneath, and coated with aluminum or zinc. Designed to meet building code requirements, they come in four basic models. Model 3021 is a double cantilevered canopy with 30-ft width over a row of single V columns, erected to provide bays 20 ft long. The roof protrudes 10 ft beyond last V-column at each end. Both bay and roof arrangements provide maximum parking maneuverability. Having the same dimensional ranges, Model 3022 is a double cantilevered canopy supported by two rows of tapered columns, separated to create a walkway area between the rows.

Model 1520 is a free standing, single cantilevered structure with 15-ft canopy. Supported by offset, angled columns spaced to provide 20-ft bays, this canopy is suited to sloped terrain. The fourth model, a custom flat roof canopy

(such as shown) is supported by box beams resting on pipe columns and available in widths to 40 ft, as well as a variety of post spacings and clearance heights. The roof panels need no additional structural support. Armco Drainage & Metal Products, Inc.

For details, circle 45 on Post Card

PLASTIC CONTROL CABLE is smaller and lighter

Okonite P-30 is a small diameter plastic control cable for general purpose installation in conduit, aerial, duct, tray, direct burial, wet or dry locations. Described as 30 per cent smaller and lighter than conventional types, it features multi-wall construction, with dielectric basic conductor insulation, protective covering and overall jacket for three-fold electrical protection. Low in cost, the cable is recommended by manufacturer for d-c circuits in wet locations and for temperature ranges to 75 C. The Okonite Co.

For details, circle 46 on Post Card

NEOPRENE GLOVES protect hands, products too

Stanzoil N-37 Whitecap Gloves are for use where both sanitary handling of products and worker hand protection is

required. Of milled Neoprene, these lightweight flexible gloves are white outside with red satinized lining. They have an embossed, non-slip grip, and

1.*

DAYLIGHTING DO's and DON'Ts

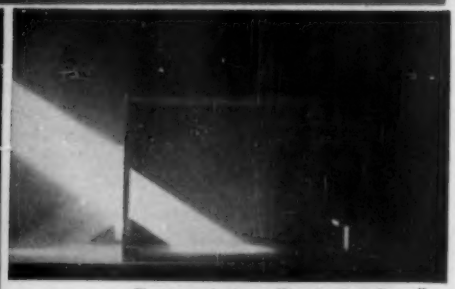
FOR PROGRESSIVE PLANT ENGINEERS

* No. 1 of a series to help Engineers increase plant efficiency and economy.

DON'T expect maximum daylighting value from just any glazing medium

In good industrial daylighting practice, the problem is to provide enough light at working levels distant from the windows while avoiding a high concentration of lighting next to windows. To accomplish this uniformity of lighting, some diffusion must be employed to throw a portion of the available light directly to the far side of the room.

Translucent light diffusing glass by Mississippi is "Visioneered" for better daylighting, scientifically designed to distribute light to best advantage. Furnished wired and unwired in a variety of industrial patterns and surface finishes, Mississippi rolled glass is available at leading distributors of quality glass.

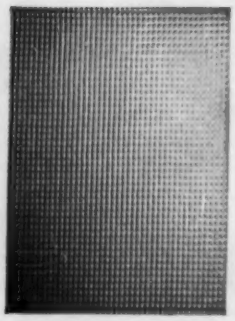


Photograph shows "Smoke Box Room" with its window glazed with clear glass.

Smoke Box photo showing window glazed with a diffusing glass.

DO INSIST ON GLASS FOR GLAZING

In buildings new or old, glass and glass alone possesses the desirable characteristics of chemical stability, permanence of finish, color, shape, surface hardness and non-inflammability. Buy, specify, insist on glass. See your Mississippi Glass distributor.



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MISSISSIPPI GLASS COMPANY

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NEW YORK • CHICAGO • FULLERTON, CALIFORNIA

WORLD'S LARGEST MANUFACTURER OF ROLLED, FIGURED AND WIRED GLASS

For more facts circle 607 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

curved finger and hand areas. Manufacturer says the gloves resist chemicals, oils, acids, caustics, solvents, greases, oxidation and ozone cracking, and withstand abrasion and hard usage. Gloves come in three sizes, their 10½-in. length protects wrists and lower arms. The Pioneer Rubber Co.

▲ For details, circle 47 on Post Card

To receive product data circle item numbers on the handy Reader Service Cards provided on page 227-228.

ILLUMINATOR for low cost concentrated lighting

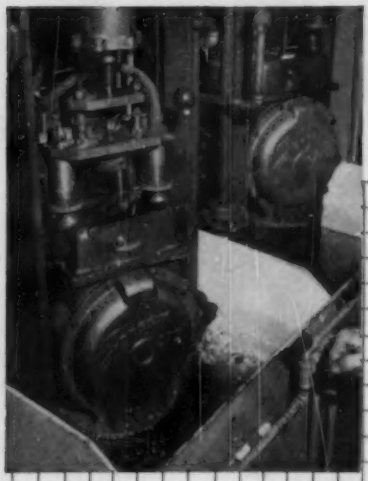
For inspection of small components, close-up production work, machinery inspection etc., the Edscorp Reflect-All Illuminator provides concentrated

yet diffused light where needed. It features an internally ½ silvered and semi-frosted tubular bulb of 40 w. A removable spot lens is supplied to permit further concentration of light. The unit has a brown metal base, 12-in. long gooseneck, and 6-ft cord. It costs around $10.00. Edmund Scientific Co.

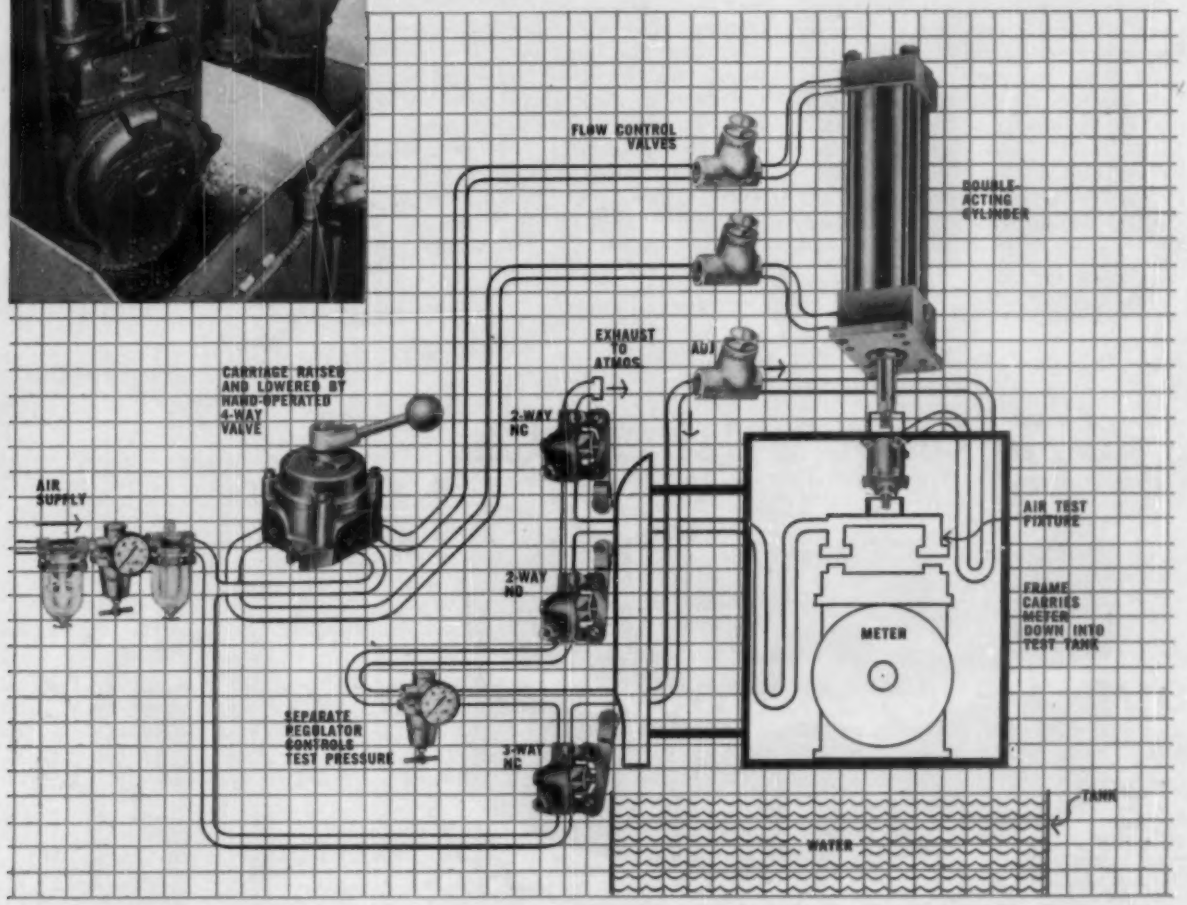
▲ For details, circle 48 on Post Card

NON-LUBE COMPRESSOR for heavy duty service

Model ICA, a balanced/opposed air compressor driven by a flange mounted electric motor, is designed for continuous heavy-duty service in applications where lube oil contamination of the air stream cannot be tolerated. Piston rings and rod packing are tough, self-lubricating Teflon. The non-lube cylinder is connected to the crankcase by an extra long distance piece, internally divided into two compartments by a baffle plate which houses oil scraper piston rod packing. This arrangement isolates the compressor cylinder from



Here's how one company tests its products with air. This air circuit of Schrader Products at the Sprague Meter Company in Bridgeport, Connecticut, automatically clamps meter ports airtight, lowers meter into water, and fills it to test pressure. Operator looks for telltale bubbles from leaks, then presses lever to raise meter automatically. Says the Plant Manager: "This used to be a slow, arduous process. Now a meter's in the water, under pressure, in less than a second."



MANUFACTURER SETS UP CRITICAL TEST IN LESS THAN ONE SECOND— WITH SCHRADER AIR PRODUCTS

As products grow more complex and precise, many manufacturers are *simplifying* their operations—with air cylinders, valves, fittings and simple schematic planning. They're installing their own circuits, as this manufacturer did, or letting Schrader experts help. For example, Schrader Air Products can inspect, test, assemble, package—do work faster, more accurately—save effort and money.

Never forget air can make almost any motion human hands can—push, pull, hold, position, or move repetitively. And air doesn't get tired—has more powerful muscles. Maintenance? Almost nil.

Take full advantage of your air power by automating with Schrader—the most complete line of Air Cylinders, Valves, and Accessories. Schrader engineers have experience and know how to help you cut your operating costs.

Select your automating equipment from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

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A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
484 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

For more facts circle 608 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

the main compressor lubrication system. To further prevent lube oil contamination of compressor piston rod and piston rod pressure packing, an oil slinger is placed on the rod between oil scraper packing and pressure packing. Model ICA is a 6-in. stroke machine built in four sizes rated from 75 to 150 bhp. Clark Bros. Co.

▲ For details, circle 49 on Post Card

SAFETY SWITCHES stand 200,000-amp short circuits

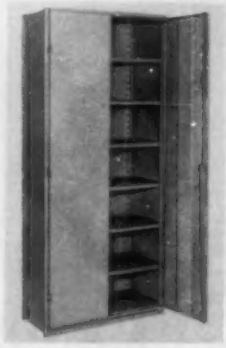
Type TH (heavy duty) and Type THD (heavy duty interrupter) Switches are announced as capable of withstanding the energy of a 200,000-amp short circuit when used with the company's CLF high capacity fuses or other current limiting fuses of comparable characteristics. According to manufacturer, these devices meet the need for a relatively low cost enclosed safety switch capable of protecting heavy electrical equipment installed where available short circuit current exceeds 100,000 amp rms. Employing silver alloy, refractory-type contacts of the kind used in molded case circuit breakers, THD Switches come in ratings from 30 to 600 amp, 250 and 600

v a-c. Type TH Switches available in same ratings. General Electric Co.

▲ For details, circle 50 on Post Card

CLOSED STEEL SHELVING with lockable doors

The 5-T Series of closed steel shelving features lockable doors for storage of tools, parts, costly materials and merchandise. Units are 36 in. wide and 89



in. high, with shelves 12, 18 or 24 in. deep. Standard section contains eight shelves. Doors are heavy gage steel, with grooved key lock in handle. Standard colors are gray and green. Penco Div., Alan Wood Steel Co.

▲ For details, circle 51 on Post Card

MOTION DETECTOR gives more security at lower cost

SWAMI (standing wave area motion indicator) is announced as a simple to install, simple to maintain security system which detects motion into or within a confined area and saturates that area with a pattern of radio frequency energy. Any motion, however slight, is claimed to interrupt the standing wave pattern, causing a voltage change at the sensor unit which is transformed into both audible and

This year is your 25th anniversary. It's twenty-five years since you asked for corrosion prevention. It's twenty-five years since Electro Rust-Proofing designed and installed your first cathodic protection system.

ERP has expanded in those years. Today, ERP's worldwide organization protects pipelines, water towers, clarifiers, docks, ships' ballast tanks, and other submerged and buried metals. We've improved our methods . . . pioneered new equipment . . . brought automation to cathodic protection.

We're working now to give you even greater value, even better service for your cathodic protection dollar. To us, this milestone is not a monument. It's a stepping stone towards a corrosion-free future—with ERP.

To those who don't yet know us—we'll be happy to meet you. Just write to Dept. E54.72.

ERP CATHODIC PROTECTION SINCE 1935

ELECTRO RUST-PROOFING CORP.
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CABLE ELECTRO NEWARK N J

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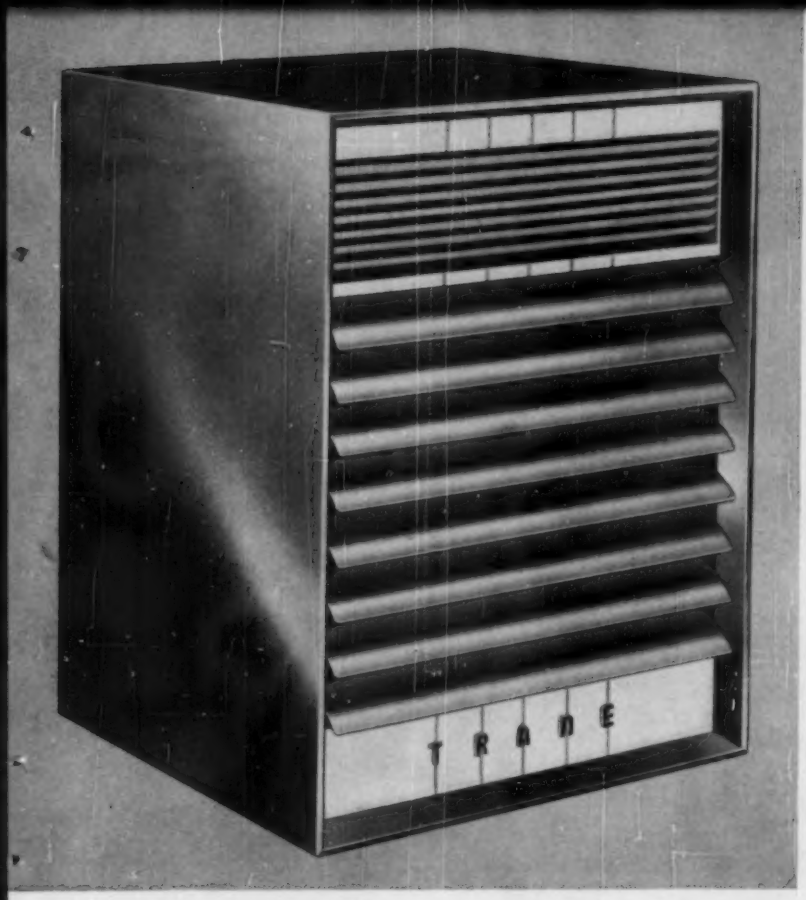
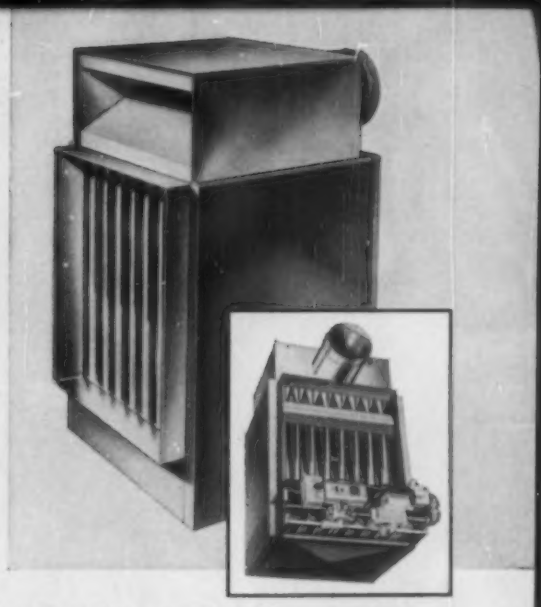




Duct heater is suitable for downstream operation in accordance with latest codes. Provides heating cycle for remote cooling units, such as the TRANE Self-Contained Air Conditioner. Drain pan (shown in inset) is standard equipment. The unit has low static resistance, is of aluminized construction. Operational modulation valve reduces input as much as 80%. 2-stage, 2-input valve available.

Propeller-type heater uses a new, quiet TRANE Fan that is designed exclusively for unit heaters. Access door on bottom of casing makes unit easy to clean. Complete range of sizes from 33,000 to 250,000 Btuh input.

New Trane gas-fired heaters have advanced styling, compact design!

High-performance blower and propeller units—plus duct models approved for downstream operation

Here's a new line of gas-fired heaters from TRANE that combines smart, modern appearance with peak performance and versatility! These TRANE Heaters are ruggedly built for long life—yet they're light in weight, compactly designed for use where space is at a premium.

Three basic types are available: propeller, duct and blower. All models feature an aluminized steel, all-welded heat exchanger that assures long, trouble-free operation. The steel, ribbon-type burners have stainless steel inserts. And the burners are removable individually for service and maintenance.

The TRANE Duct Heater may be used for downstream operation, for use with remote cooling units (such as the TRANE Self-Contained Air Conditioner). All parts of the duct heater that are exposed to the cold air stream are of aluminized construction—including the drain pan, which is standard equipment.

True 2-speed, 2-input propeller units available in 5 sizes. The motor speed and gas input can be automatically cycled to maintain more even temperatures; to provide greater operating economy.

The light weight of these new TRANE Heaters means more Btu's per pound. Freight costs are lower; and installation is simplified: minimizes the need for expensive structural reinforcement.

WANT MORE FACTS on these gas-fired heaters? Just ask your nearby TRANE Sales Office; or write TRANE, La Crosse, Wisconsin.

Blower-type heater uses a forward-curved centrifugal fan. Free delivery or duct work installation; adjustable fan belts to provide proper air delivery against varying static pressures. Streamlined fan inlet for exceptionally quiet operation. Louver-Fin Diffusers increase air throw. Sizes from 33,000 to 250,000 Btuh input.

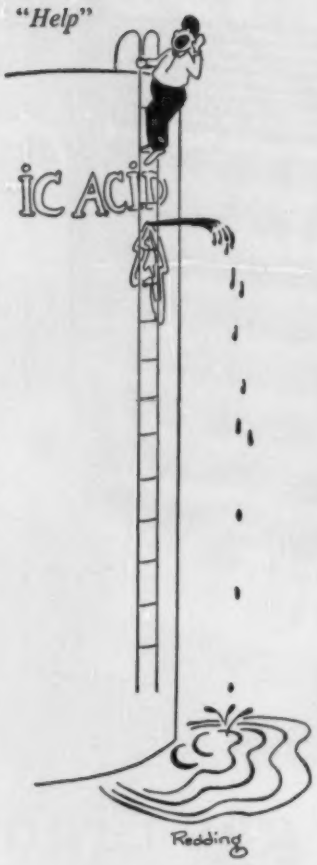
For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA.
CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY
OF CANADA, LIMITED, TORONTO • 100 U. S. AND 10 CANADIAN OFFICES

Life in these excited states...



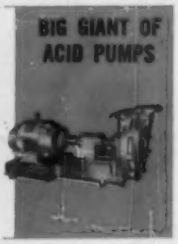
Ever "Treed" by Corrosion?

Ever left high and dry by corrosion . . . sweating out repairs, shut-downs, wasted materials? You can solve 85 to 100% of these problems once and for all with Ace chemical resistant piping, valves, pumps, tanks and other equipment. It doesn't *cost* . . . it *pays*.

Best non-metallic pipe anywhere for *hot* chemicals to 275°F. Also handles tough organics. Rigid, tough nitrile. Pipe and fittings to 8". *Bul. 96A.*

Ace chemical-resistant rubber-lined steel pipe best for high-pressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".

Heavy Ace rubber and plastic tank linings unexcelled for alkalies, acids, bleaches, salts. Faultless seams, indestructible bond, shock and age-resistant. All shapes. *Bul. CE-53.*



Highly efficient *WE* pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.

ACE *chemical resistant equipment*
BY **AMERICAN** HARD RUBBER COMPANY
DIVISION OF **AMERACE** CORPORATION
ACE ROAD • BUTLER, N.J.

See ACE equipment in Chemical Engineering Catalog

For more facts circle 611 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

visual alarms at the control station—which may be several miles from the area under surveillance. An attempt to tamper with the inter-connecting cables in this system causes an immediate alarm, manufacturer states.

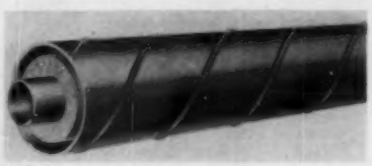
The system comprises four units: the sensor, the day/night sensitivity control box, power supply and monitor. The SWAMI is operated from 110-v a-c power, which feeds a regulated power supply. Sensitivity is adjustable to cover large or small areas. Singer Military Products Div.

For details, circle 52 on Post Card

PIPING SYSTEMS for overhead and underground lines

For the overhead distribution of steam, hot water, process liquids and refrigeration lines, the Plasti-clad System consists of pipe and insulation covered with aluminum foil, over which are two wrappings of fiber glass cloth integrated within the Plasti-clad material. A final color coat of Plasti-clad is applied to finish the unit. Standard color is green, others may be had. The system is prefabricated complete with expansion loops, anchor units, elbows and T units. Straight run units come in 21-ft lengths.

For underground distribution, a plastic coated system (illustrated)



consists of pipe and insulation covered by a spiral welded metal conduit. The conduit is protected against

Season's
Best
Wishes...
THE
AIR PRODUCTS
CORPORATION

Light IN WEIGHT
Long ON SERVICE

THE
"Philadelphia"
MODEL R
ALUMINUM
SPUR GEAR HOIST

Lightweight in all capacities—from ½ ton to 10 tons. Easy to install or move from one job to another. The half-ton weighs only 36 lbs.

Designed for low headroom and faster hoisting. Plain, durable construction for long, trouble-free service . . . will pay for itself in short order.

Call Your Distributor or Write for Catalog

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Sales Offices and Warehouses in Principal Cities

For more facts circle 613 on Reply Card

PLANT ENGINEERING EQUIPMENT

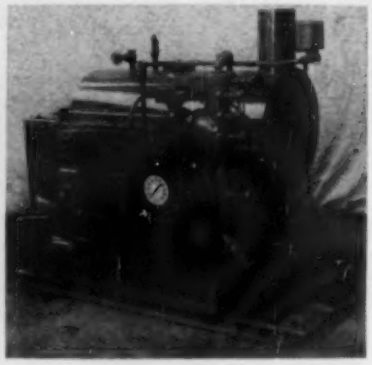
(Begins on page 186)

soil and stray current corrosion by a 20- to 25-mil coating of cold-cured epoxy coating reinforced with fiber glass cloth. Company says it is resistant to acids, alkalis and salts; has a high dielectric strength; stands continuous temperatures of 375 F, and does not crack at low temperatures. Thermal coefficient of expansion is said to be nearly the same as steel, so that expansion and contraction of the conduit will not rupture the coating. Ric-wiL, Inc.

▲ For details, circle 53 on Post Card

PACKAGED HRT BOILERS for high pressure applications

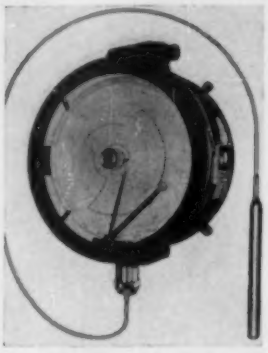
These horizontal return tubular type higher pressure boilers come assembled, wired and with all controls pre-installed. All that needs to be done after delivery is connection with utilities. Models are available for firing with light or heavy oils, with gas, or interchangeably with gas or oil. Columbia Boiler Co.



▲ For details, circle 54 on Post Card

TEMPERATURE CONTROLS available in three types

Three additions to this company's RC line of automatic programming, recording temperature controls include a potentiometer-type proportioning instrument, a two-point control and an adjustable-differential recorder-controller which is especially designed for long switch life. Programming is accomplished by cutting the pre-determined time-temperature pattern for heating or refrigerating on a plastic cam to be mounted on the face of the instrument. Temperatures throughout the program are recorded on round, 10-in. paper charts calibrated according to programmed process. Model RCP, the potentiometer control, is a modulating one offering close control sensitivity. The two-point control, Model RCSS, is for use where two temperatures are specified as control points,



and are separated by not more than 5 per cent of scale range. Model RCL, for control of fuel valves or relays to start and stop combustion systems or electric heater loads, has an adjustable differential switch. Partlow Corp.

▲ For details circle 55 on Post Card

HEAT PELLETS thaw frozen drains and melt snow

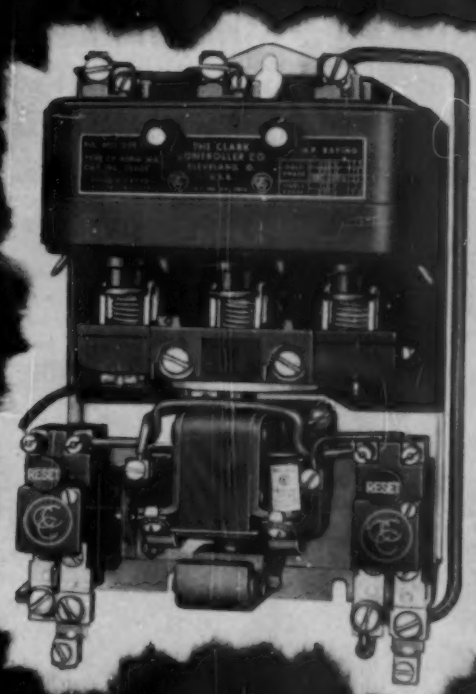
Ice-Chaser is described as a non-corrosive compound of heat generating chemicals in pellet form. According to company, a few pellets placed in ice-packed drains and gutters thaws them up to 30 times faster than rock salt. It can also be used over snow-packed loading zones and parking areas. The product is said to leave no residue and be non-injurious to walks or drives. Consolidated Paint & Varnish Corp.

▲ For details, circle 56 on Post Card

ONE-PASSENGER TRUCK can operate in 25-in. aisles

For plant engineers and others who make frequent trips throughout a plant, the electric Truckster is described as highly maneuverable and economical to operate. It has a heavy-duty wedge-belt drive and coil spring suspension on all wheels;

What's the measure of starter performance?



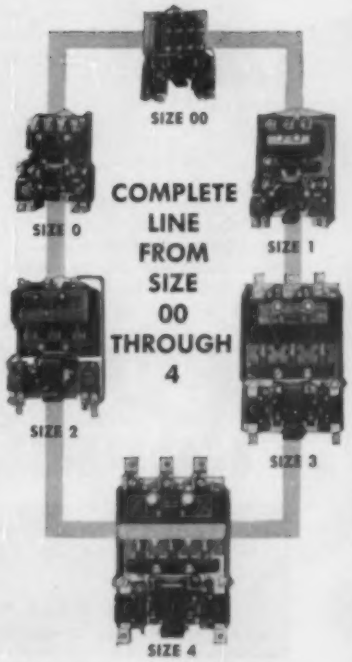
COMPARE RELIABILITY

Clark "CY" Magnetic Starters give you more

Buy on proof of performance! Make your own comparison and see how reliable an AC starter can be in the toughest applications you can find. Compare under any operating conditions and you will see why verified user reports underscore the reliability of Clark "CY" design... the performance advantages of "CY" engineering... the care and attention to detail of "CY" manufacture.

Your own comparison will also prove that Clark's rugged AC magnetic starters give you more added safety, service life, ease of installation and economical maintenance. The comparison costs you nothing—the proof can save you money!

Clark Type "CY" AC Magnetic Starters are available in many combinations and in a variety of enclosures to meet every industrial application. Your local Clark distributor or district sales representative will be glad to help you set up your own comparison tests. Ask him for literature on the complete Clark Type "CY" Starter line. Or write direct.



The **CLARK CONTROLLER** Company

"Everything under Control"

Main Plant: *Cleveland 10, Ohio* • **Western Plant:** *Los Angeles 58, Calif.*
In Canada: *Canadian Controllers, Limited, Toronto*

For more facts circle 615 on Reply Card

TURN SCRAP HANDLING INTO A PROFIT!

Segregated scrap brings higher prices. Add the convenience of easier collection and easier handling, and in most cases you can convert scrap handling from a loss to a profit.

DUMPS ITSELF

RIGHTS ITSELF

LOCKS ITSELF

Hundreds of industries now use Roura Hoppers to collect scrap metal. They're placed alongside machines or in strategic locations. When full, a lift truck picks up the loaded hopper . . . transports it to scrap bin or freight car . . . flips the latch . . . and the hopper *automatically* dumps itself, rights itself, locks itself.

Roura Hoppers are made in eight standard sizes . . . in ½ to 4 yard capacities. Ruggedly built of 3/16" steel plate with continuous arc-welded seams, the hoppers give years of continuous service. Heavier plate, stainless, aluminum or galvanized is also available if desired. Standard models shipped from stock.

Specifications are available without obligation. Phone us collect at Townsend 8-3560 or use the handy coupon.

ROURA
Self-Dumping
HOPPER

WANT MORE DETAILS? Just clip this coupon to your letterhead, sign your name and mail to:

ROURA IRON WORKS, INC.
1413 Woodland Ave., Detroit 11, Mich.

For more facts circle 616 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 186)

forward speeds of 5 and 11 mph, reverse speed of about 5 mph. An automotive type pedal controls starting and stopping. According to company, the Truckster can turn in a 70-in. space; it travels up to 40 miles before it has to be plugged into a 110-v outlet for battery recharging. Has a 2 cu ft carrier space for records, etc. Cushman Motors.

▲ For details, circle 57 on Post Card

PORTABLE TOOL BENCH rolls up

Roll-On Bench offers a choice of 22 interchangeable drawers which may be locked, plus 24 small parts pockets. Four wheels enable the bench to be

pushed right up to the job. Large top may be used as workbench or for mounting additional equipment. Bench is available in three sizes. Large model is capable of carrying 1500 lb. Roll-On Mfg. Corp.

▲ For details, circle 58 on Post Card

LIQUID CHILLERS are compact and accessible

For air conditioning or industrial cooling applications, the Versare line of hermetic packaged liquid chillers is announced as featuring versatility, compactness, ease of servicing and safety. Eleven models—in small capacity increments—cover net rated capacities to 67.1 tons, depending on condenser water temperature conditions and desired leaving chilled water temperature. Standard units are also available without condenser and with accessories for remote condenser applications. The package design requires minimum water piping and electrical connections, and the units are slim enough to pass through a 36-in. doorway.

Features include automatic safety switches for motor overload, high temperature, low oil pressure, high condenser pressure or low cooler pressure. To protect operating and maintenance personnel, the control panel is divided into two separate compartments: one for 115-v control circuit, and the other for the higher voltage power circuit. Industrial Div., American-Standard.

▲ For details, circle 59 on Post Card

VIBRATING CONVEYORS are dynamically balanced

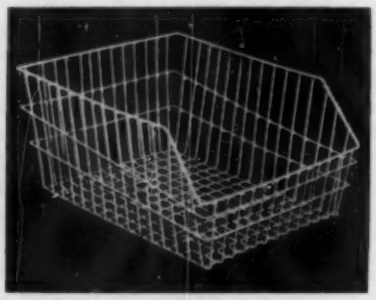
Twin Mass Mechanical Vibrating Conveyors are described as dynamically balanced units with non-positive or

reactive type drive offering smooth conveying action which responds to any change in amplitude of stroke. A drive shaft to which weights are attached on one side forms an eccentric or unevenly balanced weight. Unit is designed with V-belt drive from a standard electric motor, or variable speed control. Sizes range from 12 to 48 in. wide in lengths to 30 ft; capacities from a few tons to 200 tons per hour. The Jeffrey Mfg. Co.

▲ For details, circle 60 on Post Card

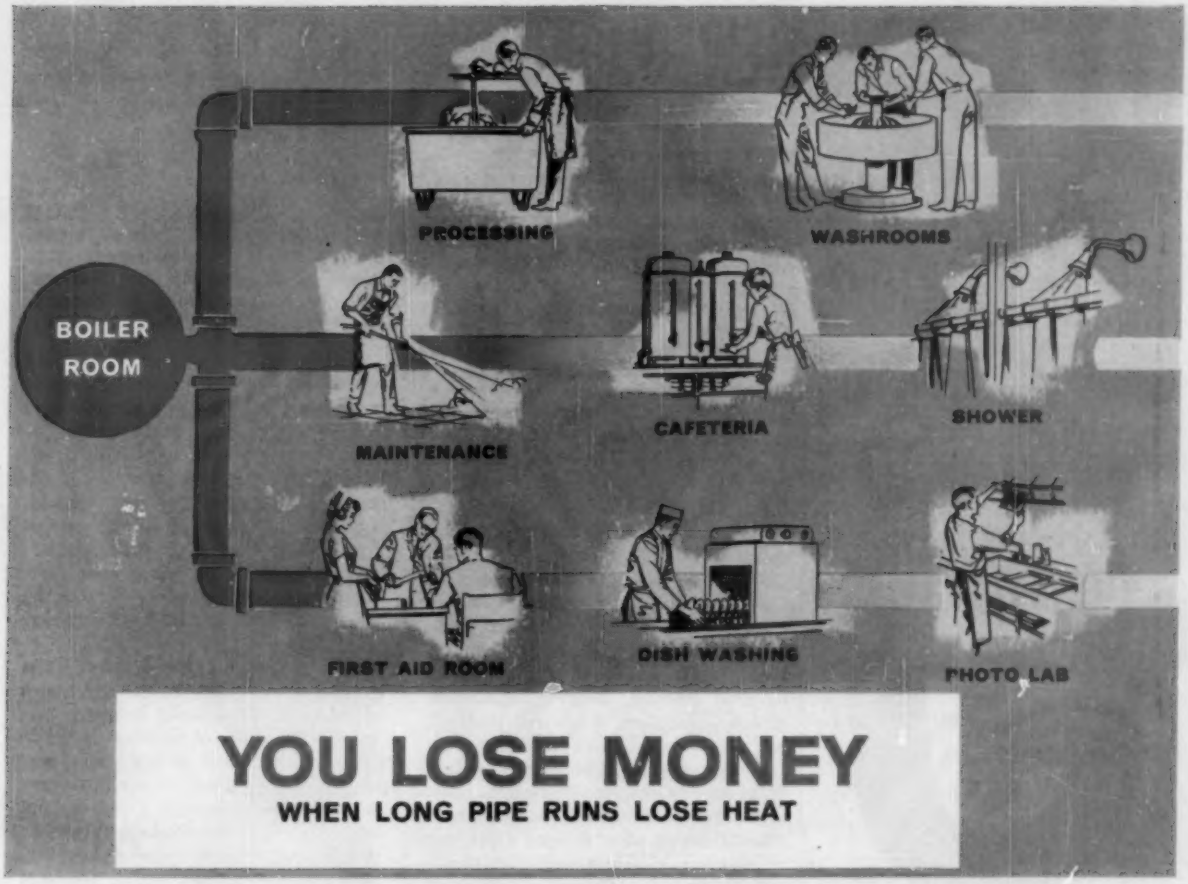
PLASTIC COATED BASKETS for small parts handling

Coated with Plastisol, 2500 Series All-Purpose Baskets are designed for carrying or storing small parts or products, especially odd shapes such as tools and round or cone shaped items difficult to store on



shelves. Coating is described as durable, rust-resistant plastic, difficult to strip or damage, and able to withstand extreme punishment, impervious to oil, grease and many chemicals. Sides are slanted for easy stacking. Abbey Wire Works, Inc.

▲ For details, circle 61 on Post Card



BURKAY industrial water heaters—spotted at the points of use—eliminate costly heat losses in long piping runs

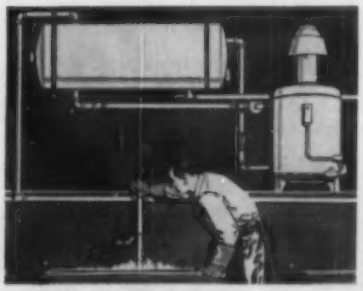
If your plant's water heating system resembles the one above, you're wasting heat *and money* three ways: (1) When the line is cool, you waste the fuel and heat it takes to fill the line with hot water. (2) You waste heat by storing high-temperature water (for example, storage of 180° sanitizing rinse for your plant cafeteria). (3) Your large boiler operates inefficiently when it serves small loads.

The best way to eliminate these heat and dollar losses: Locate Burkay industrial water heaters *at the points of use*. Burkay water heaters are specially designed to meet the tough demands of industrial applications.

So you get . . .

- All the hot water you need at any temperature you need (or at two different temperatures).
- Water temperature accurately and automatically controlled within 2°F.
- Economical hot water from a highly efficient heater which operates *only* when you need hot water.
- Long service-life and rust-free hot water because Burkay heaters have copper, brass, or bronze waterways; cannot rust or corrode.

These are only a few of the many reasons it will pay you to investigate Burkay industrial water heaters. Get the full story by returning the coupon.



BURKAY'S COMPLETE LINE of water heaters are specially designed for industrial applications; can be mounted overhead to save valuable floor space.

Burkay®

Through research ... a better way

A.O.Smith

PERMAGLAS DIVISION

KANKAKEE, ILLINOIS • NEWARK, CALIFORNIA

A. O. Smith International S.A., Milwaukee 1, Wis.

FREE BOOKLET

A. O. SMITH CORPORATION
Permaglas Division, Dept. PE-1260
Kankakee, Illinois

Please send me information on Burkay industrial water heaters and water heating systems for industrial plants.

Name_____

Company_____

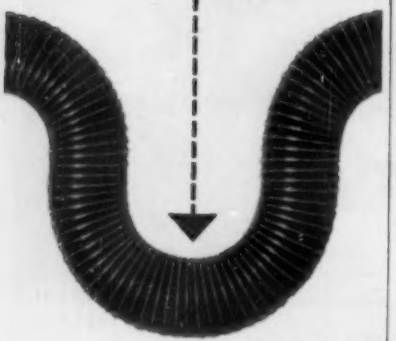
Address_____

City_____ Zone____ State_____

For more facts circle 617 on Reply Card

NEW!

EXTRA ABRASION-RESISTANT AIR DUCT



Heavier, higher-grade Neoprene coating makes Wiremold's new Type 8R exceed other flexible ducts in abrasion resistance — for materials handling and heavy abrasive exhausting jobs.

Get all the facts from your distributor, or write us for folder and sample of new Type 8R duct.

OTHER TYPES FOR

- General industrial ventilation.
- Chemical and corrosive fumes.
- Many other uses.

WIREMOLD®

AIR DUCT

THE WIREMOLD COMPANY • HARTFORD 10, CONN.

THE WIREMOLD CO., HARTFORD 10, CONN. 12-OP

☐ Send NEW folder.

☐ Send sample of NEW 8R.

Duct use: _____

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name _____

company _____

address _____

city _____ state _____

For more facts circle 618 on Reply Card

NEW BOOKS

for the plant engineer

Plant Architecture

INDUSTRIAL ARCHITECTURE by James F. Munce. Size 12⅛ by 9¾ in.; 232 pp including index; illustrated; cloth bound. Published by F. W. Dodge Corporation, 119 West 40th Street, New York 18, N. Y. Price $14.75.

AUTHOR of this book is a senior partner of Munce and Kennedy, an architectural and engineering firm. With the emphasis on the significance of the architect, the book includes information on the industrial plant architecture in Great Britain, West Germany and the U.S.

Industrial districts and British industrial estates are taken up in one of the chapters. In another section there are comments on general structural requirements, types of roof structure, external cladding, flooring, insulation, glazing, corrosion, doors and shutters, and single vs multistory design.

The book also includes information on plant services, fire protection, heating and ventilating and the relation of automation to plant design.

In several chapters highlights of activities and considerations are presented for different industrial classifications such as heavy, light, process, and utilities.

Man-Hour Estimate Tables

ESTIMATOR'S GENERAL CONSTRUCTION MAN-HOUR MANUAL by John S. Page. Size approx. 9¼ by 7⅛ in.; over 200 pp; cloth covered, plastic retainer for loose-leaf pages. Published by Gulf Publishing Company, Book Div., 3301 Buffalo Drive, Houston 1, Texas. Price $10.00.

DATA-PACKED manual contains time-saving information for use by those concerned with the estimation of man-hours required for construction work. In its contents are included many tables relating to a variety of operations.

Tables carry man-hour estimates on such activities as demolition; site-grading and structural excavation; concrete roadways; formwork; concrete work; masonry; carpentry and millwork; special walls and ceiling; roofing and siding; and painting.

An important discussion appears in the introduction on the factors that enter into the determination of the composite monetary rate of payment per hour. An example shows the development of the composite rate for a hypothetical crew. Comments also take in the productivity efficiency; in the case of the example a definite percentage has been selected for the average productivity.

Fire Codes

BUILDING CONSTRUCTION AND EQUIPMENT. Size 8⅝ by 5¾ in.; over 800 pp; illustrated; cloth bound. Published by the National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass. Price $7.

THE DEGREE of fire protection and prevention hinges strongly on the quality of advance action. Fire possibilities must be weighed carefully, gravity of consequences seriously considered, strong measures taken to avoid building fire and reduce damage and loss, if one occurs. For assistance in this direction use can be made of information available from recognized individuals and organizations. Among the latter is the National Fire Protection Association.

This association publishes fire codes grouped under different general topics of interest. This book, designated as volume III, is one of seven of the 1960-61 editions. Some of the codes presented in this publication are those pertaining to the following: fire doors and windows; air conditioning systems; blower and exhaust systems; building exits; roof coverings; spark arresters for chimneys and stacks; water cooling towers; and protection of records.

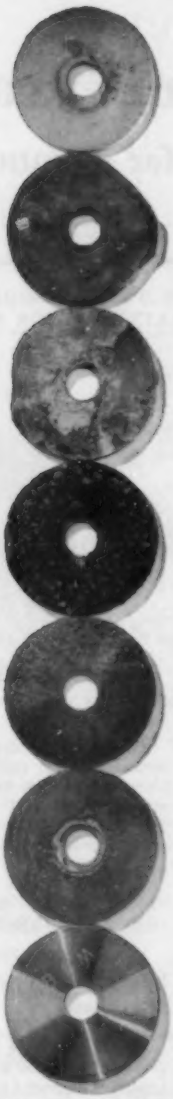
Plastic Facts, Future Outlook

POLYSTYRENE by Wm. C. Teach and Geo. C. Kiessling. Size 7⅝ by 5¼ in.; 176 pp including index; illustrated; cloth bound. Published by Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. Price $5.00.

THE REINHOLD Plastics Application Series continues with this 18th volume. It is a simplified, technically accurate approach to the subject of polystyrene. Fabrication techniques are discussed briefly in this book. These include injection molding, extrusion, blow molding and the compression method.

Applications of polystyrene presented in one of the sections relate to appliances, electronics, building, packaging, housewares, toys, etc.

The treatment of the subject of polystyrene foam takes in short coverages of the method of manufacture and also fabrication techniques. It includes discussions of the properties of this material and applications. Among the latter are those pertaining to construction activities. In the last chapter an outlook to future possibilities for the use of polystyrene is projected.



Which valve alloy?

Corrosion testing, which often includes analysis of test specimens like those shown above, insure Aloyco valve customers of the right alloy for each job. Typical metals used in Aloyco Valves: Types 304 and 316 Stainless Steel, Aloyco 20, Nickel, Monel, Hastelloy B, C and D.

At Aloyco, 30 years experience in stainless steel valves exclusively is at your service. Our field consulting service is yours for the asking.

On your next valve job call in the specialists . . . write Alloy Steel Products Company, 1308 West Elizabeth Avenue, Linden, New Jersey. 9.14

Longer Lasting ALOYCO VALVES

ALLOY STEEL PRODUCTS COMPANY
Linden, New Jersey
For more facts circle 619 on Reply Card

Industrial Plant Construction

(Continued from page 179)

started construction of a 560,000-sq ft manufacturing plant in East Whiteland Township, about 25 miles west of here. New structure will house pharmaceutical manufacturing, laboratory and warehousing operations of the company. Work already under way is targeted for completion early in 1961. Cost of the plant and equipment is reported to be about $8 million.

Beaumont, Texas—Foster Grant Co., 289 N. Main St., Leominster, Mass., plans to construct a multi-million dollar polyethylene plant here, which it expects to complete by mid-1961. Plant will be erected adjacent to the Mobil Chemical Co. ethylene plant. Companies will work together on the development of high pressure polyethylene.

Bishop, Texas—Celanese Corporation of America, 180 Madison Ave., New York, N. Y., plans to construct a multi-million dollar plant here for the production of butylene glycol, an industrical chemical. Work on the new facility has already begun and will be completed early in 1961. Plant will have an annual production capacity of 25 million lb.

Houston, Texas—Linde Co., a division of Union Carbide Corp., 30 E. 42nd St., New York, N. Y., plans to construct a large plant here for the production of nitrogen and oxygen along with an eight mile pipeline to carry these industrial gases to customers in the Houston Ship Canal area. Work on the new plant will get under way soon and cost of the project will be about $5 million.

Longview, Wash.—Reynolds Metals Co., Reynolds Building, Richmond, Va., has authorized plans for expansion and improvement of its local aluminum metal producing plant located here. Company will spend $600,000 to provide for production of ingots for extrusions, other improved ingot products and bar stock for making aluminum conductor wire. Work on the expansion is already under way and is scheduled to be completed by the summer of 1961.

Buckhannon, W. V.,— Corhart Refractories Co., 1662 W. Lee St., Louisville, Ky., subsidiary of Corning Glass Works, Corning, N. Y., will begin construction at once on a plant for the manufacture of refractory materials. Plant will be erected on a 30-acre site and will have a floor area of 89,000 sq ft. Plant will be erected at a cost of about $1 million.

Want Tear Sheets?

If you would like tear sheets of any articles appearing in this issue, just drop a line to The Editor, Plant Engineering, 308 East James St., Barrington, Ill.

AUTOMATED *Hydral-60* PINCH VALVE SYSTEMS

Controlled circuitry for any operating requirements

- The Masseo-Grigsby Hydral-60 System consists of one or more pinch valves with a single automatically operated hydraulic pump.
- Hydraulic pump may be operated by electric motor or by air from normal plant supply system.
- Valves may be the same or different size.
- Valves in the system may be operated simultaneously or independently.
- Control valve may be manual or solenoid.
- Valves may be coordinated and interlocked with other plant equipment to automatically control tank levels, rate of flow, etc.
- Valves are self-supporting and may be operated in any position from horizontal to vertical.
- Valves may be independently controlled for normal or rapid closure.
- Valves may be held fully open, fully closed, or at intermediate positions.
- Remote control to meet individual requirements.
- Controls may be included for automatic emergency operation.
- 3" to 14" I.D. sizes, with 50, 100, and 150 psi line pressure ratings.
- Temperatures to 200° F.

WRITE FOR NEW CATALOG NO. 609

Manufacturing Division

MINE AND SMELTER SUPPLY CO.

3800 RACE STREET • DENVER, COLORADO
OFFICES AND AGENTS IN PRINCIPAL CITIES
For more facts circle 620 on Reply Card

Maintenance and Steam Traps

. . . there's a relationship that goes far beyond trap maintenance alone

Good traps and good trapping have a greater effect on your maintenance costs than does trap maintenance itself. By that we mean that the right traps, properly selected and installed, and with the benefits of a preventive maintenance program, will save far more maintenance dollars than they will cost.

Under the pressure of spiralling maintenance costs, this thought becomes mighty important. Let's take a look at what it involves:

Proper Selection of Steam Traps

1. Be sure it's the right type of trap.

2. Be sure it's sized right and is for the correct operating pressure.

3. Be sure it's first rate in design and construction.

Proper Installation of Steam Traps

1. Install them so they are accessible for inspection and maintenance.

2. Install a test valve.

3. Use a union or unions.

4. Use a shutoff valve or valves.

5. Use a strainer ahead of the trap if dirt conditions are bad.

6. Use a by-pass only where continuity of service is imperative.

7. Standardize inlet and outlet connections.

Preventive Maintenance Program

1. Test trap regularly for proper operation. (Trap size, operating pressure and importance determine frequency.)

2. Inspect internal mechanism at least once a year.

You Get Indirect Benefits As Well

The direct benefits of the plan outlined are pretty obvious — good traps, properly selected, require less maintenance . . . testing and inspection prevents troubles that lead to maintenance.

However, this plan provides indirect benefits which reduce maintenance in other parts of the plant as well:

Good traps save steam and burning equipment and on ash handling equipment.

Good traps protect the system by eliminating water hammer and preventing the damage it can do.

Good traps discharge carbon dioxide before it can go into solution to form corrosive carbonic acid —less corrosion, less maintenance.

Good traps increase production to reduce the length of time equipment must operate or reduce the amount of equipment needed . . . either way maintenance is reduced.

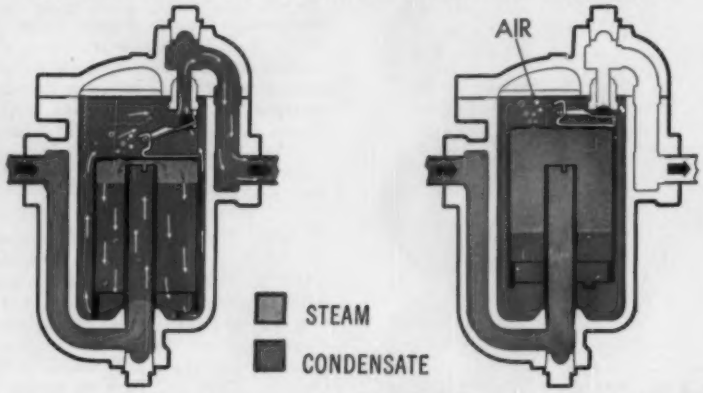
How to Go About It (The Sales Pitch)

We admit we're prejudiced, but we don't think there is any better way to select steam traps than with the help of the 44 page Armstrong Steam Trap Book. Here in a single source is specific data on the selection and sizing of traps, how to install them for best results, and how to maintain them most economically.

The Steam Trap Book will also give you full information on the design and construction of Armstrong Inverted Bucket Steam Traps that offer these important maintenance-reducing advantages:

1. Armstrong Traps are dependable.

HERE'S THE STEAM TRAP DESIGN THAT CAN REDUCE YOUR MAINTENANCE PROBLEMS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

2. Armstrong Traps require no adjustments — go from full load to zero load automatically.

3. Armstrong Traps are self-scrubbing—ordinary dirt conditions can't hurt them.

4. Armstrong Traps have long-life parts — valve and seat are heat treated chrome steel — lever assembly and bucket are stainless steel.

5. Armstrong Traps have water sealed valves to minimize wire drawing and erosion.

Ask for your copy of the Steam Trap Book—there is no obligation. Then test Armstrong Trapping. If you are not completely satisfied with the results, you can return the traps for a full refund of the purchase price. You can't lose much that way. Call your local Armstrong Representative or Distributor, or write

Armstrong Machine Works
9126 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

For more facts circle 621 on Reply Card

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BARRINGTON, ILL.

BUSINESS REPLY MAIL

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PLANT ENGINEERING
308 East James St.
BARRINGTON, ILLINOIS

DECEMBER, 1960
This card good only until March 31, 1961

PLANT ENGINEERING

Please have manufacturers send without obligation information or bulletins indicated by numbers circled.

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(Company name must be given. If you prefer delivery at home, also fill below)

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Use this space to ask for tear sheets, other information wanted. .....

DECEMBER, 1960
This card good only until March 31, 1961

PLANT ENGINEERING

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Company Address..... City..... State.....

(Company name must be given. If you prefer delivery at home, also fill below)

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BULLETINS

(Begins on page 23)

Casters Compared—This pocket-sized 75-pp booklet compares company's casters to those of five other manufacturers, listing virtually every caster model and its physical characteristics. Comparisons in the dimensional charts include plate size, wheel type, capacity, overall height, mounting hole space, diameter, bearings, finish, and other data for determining operational value. The Colson Corp.
▲ For a copy, circle 146 on Post Card

Industrial Casters—Described in Bulletin 91560 are casters for every industrial requirement. Shows special application casters, including V-groove, spring-action, grease-sealed and scaffold casters, together with various types of wheels, stem casters and locks. Faultless Caster Corp.
▲ For a copy, circle 147 on Post Card

Pallet Guard—This product bulletin tells how the maintenance of broken pallets can be reduced to a minimum with pallet guards made of electric welded cold roll mechanical steel tubing. Various types of guards are illustrated. Tier-Rack Corp.
▲ For a copy, circle 148 on Post Card

Adjustable Storage Racks—Detailed information on adjustable storage racks with lock-in shelf beams is presented in this 8-pp bulletin. Shelf beam loads are shown on graph in load pounds and span inches. Palmer-Shile Co.
▲ For a copy, circle 149 on Post Card

Coordinated Handling—New Techniques and applications of materials handling equipment and systems in warehousing, manufacturing and other areas are described in 46-pp Catalog GC-1. Covers principles of a coordinated materials handling system, gravity conveyors, powered conveyors, framing material and live storage racks, overhead conveyors, industrial conveyors, conveyor system accessories, casters and wheels. The Rapids-Standard Co., Inc.
▲ For a copy, circle 150 on Post Card

SLINGS, WIRE ROPE

Wire Rope Slings—Detailed information on wire rope slings is presented in this 84-pp product catalog. Each of the major types of slings is described, complete with illustrations and charts, and selection details and basic rules of hitching included. The Colorado Fuel and Iron Corp.
▲ For a copy, circle 151 on Post Card

Alloy Chain Slings—Design features and advantages of alloy chain slings and connectors are detailed in 16-pp Bulletin AD 638. Stresses long life and safety features and includes specification tables. Wire Rope Div., Jones & Laughlin Steel Corp.
▲ For a copy, circle 152 on Post Card

How to Use Wire Rope—Comprehensive information on use and abuse of wire rope is presented in this pocket size 92-pp manual adopted from company's wire rope handbook. Covers selection of wire rope, constructions, capacities, maintenance and lubrication, breaking-in of wire rope, approved methods of seizing wire rope, wire rope attachments, attaching sockets, and includes useful decimal equivalents, wire gages, metric system units, and glossary. Macwhyte Wire Rope Co.
▲ For a copy, circle 153 on Post Card

CONSTRUCTION

Porcelain Enamel Walls—Advantages of porcelain enamel curtain wall panels are detailed in this 8-pp illustrated bulletin. Specifications on standard types of panels and photos of typical installations are included. Caloric Architectural Porcelain Div., Caloric Appliance Corp.
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Movable Wall System—Illustrated and described in this 8-pp bulletin is a movable wall system designed to fit a variety of building requirements. Describes an acoustical wall as well as plywood and glass partitions, and covers finishes, surfaces, sizes and installation details. Modern Partitions, Inc.
▲ For a copy, circle 155 on Post Card

Glass Blocks and Modules—Design flexibility and functional advantages of company's glass blocks and sculptured glass modules are described in 20-pp Bulletin GB-115. Includes technical data on light transmission, insulation value, physical performance and proper selection of block. Pittsburgh Corning Corp.
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Epoxy Compounds—Applications of epoxy compounds for repair, maintenance and new construction are described in 6-pp Bulletin SEC-759. Properties and instructions for use are included. Sika Chemical Corp.
▲ For a copy, circle 157 on Post Card

Adhesives for Tile—This 20-pp handbook covers all phases of an adhesive method of installing clay tile to all types of surfaces. Accompanied by illustrations and diagrams, gives details on application of wall tile, ceiling tile, exterior tile, and floor tile, with recommendations in connection with each, and information on leveling products, priming, setting, grouting, and caulking. Miracle Adhesives Corp.
▲ For a copy, circle 158 on Post Card

WASTE HANDLING

Incinerator Selector—This handy slide rule device is designed to simplify selection of correct incinerators for various types of installations. A slide is moved to the type of installation and the appropriate variable factor, and the recommended incinerator appears in a window opposite the number of hours of operation. Morse Boulger, Inc.
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Combustion of Sewage Sludge—Low temperature combustion of sewage sludge is detailed in this 20-pp bulletin. Describes the process which burns sewage sludge in its aqueous state without flame, and includes flow chart, conversion chart, equipment and operational results, and design data. Zimmermann Process Div., Sterling Drug Inc.
▲ For a copy, circle 160 on Post Card

ELECTRICAL

Squirrel Cage Motors—Twelve-pp Bulletin 600 describes squirrel cage induction motors in basic dripproof designs. Outlines motor applications, performance characteristics, mechanical design variations, construction details, insulation details, ratings and dimensions. Century Electric Co.
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Substation Planning—Described in Bulletin 31B9695 is a minimum investment approach to substation planning with company's Regu/Tran unit assembly which allows power transformer to be installed first, load tap changing later. Advantages are detailed. Allis-Chalmers Mfg. Co.
▲ For a copy, circle 162 on Post Card

Distribution Systems—Principles of planning industrial power distribution systems for safety, reliability and economy while retaining flexibility and provisions for future expansion are outlined in 48-pp Bulletin GEA-7139. Chapters cover choosing voltages, short circuit calculations, protective relaying, selection of unit substations, power factor corrections, and grounding. General Electric Co.
▲ For a copy, circle 163 on Post Card

Packaged Busway—Construction features of 100-amp compact packaged busway for lighting and power distribution are detailed in 10-pp Form 698. Describes advantages and applications and contains dimensional data, voltage drop curve. National Electric Div., H. K. Porter Co., Inc.
▲ For a copy, circle 164 on Post Card

Postage-free Reader Service Cards make it easy to order bulletins. Cards are provided on the facing page.

Power Switching Centers—Form F-1700 H, 12 pp, introduces power switching centers—coordinated combinations of switches, operating mechanisms, fuses and housings with single assembly ratings to safely withstand effects of closing and carrying, and, when fused, interrupting all values of current up to assigned short circuit ratings. Explains how these centers afford simplified installation at lower cost and greater efficiency. I-T-E Circuit Breaker Co.
▲ For a copy, circle 165 on Post Card

Control Center—Bulletin GED-4152 gives latest developments on company's control center with grouped control for independent or coordinated units. Describes advantages of design, installation, maintenance. General Electric Co.
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Control Units—Publication 6090 is a 20-pp guide to control units and stations for standard, heavy duty and

BULLETINS

(Begins on page 23)

oiltight heavy duty applications. Design features are illustrated and described, and applications, ratings, enclosures, modifications and accessories covered. Allen-Bradley Co.

For a copy, circle 167 on Post Card

Fuse Panels, Switches—Service entrance switches, fuse panels and switches are described in 20-pp Bulletin PL 12-29-660. Installation and application data on general-purpose switches, toggle switches, safety switches, industrial switches, and double-throw switches are included, along with engineering data giving allowable current carrying capacities of insulated copper conductors in amperes. The Clark Controller Co.

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Switches and Devices—Catalog 60 is a guide to company's complete line of fusible and circuit breaker devices. Contains over 200 pp of engineering information on construction, materials, dimensions, knockouts and weights on fusible and not-fusible safety switches, double throw safety switches, general duty switches, service equipment, circuit panels, circuit breakers, circuit breaker load centers, and other devices. The Wadsworth Electric Mfg. Co., Inc.

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Proximity Switches—Applications of company's proximity switch which functions as a limit switch, positioning control, detection device, or sensing element for all types of counters are outlined in 8-pp Bulletin EDPS-80. Specifications and a control amplifier selection guide are included. Electro Products Laboratories, Inc.

For a copy, circle 170 on Post Card

Transistorized D-C Supplies—Eight-pp Bulletin GED-4184 discusses company's standard line of precision-regulated, transistorized d-c power supplies for a wide variety of applications in utilities and industry. Contains photos and charts showing specifications. General Electric Co.

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Silicon Chargers—Featured in six-pp Bulletin AR-110 is a line of silicon chargers for six- and nine-cell industrial truck batteries. Component features are illustrated and charging characteristics plotted on graphs. C & D Batteries, Div., The Electric Autolite Co.

For a copy, circle 172 on Post Card

Aluminum Conduit Fittings—Illustrated and described in 16-pp Bulletin AL 60 are company's pressure cast aluminum conduit fittings designed to stand up under humid or corrosive atmospheres. Also describes junction boxes, accessories, switch covers, receptacles and lighting fixtures. Appleton Electric Co.

For a copy, circle 173 on Post Card

Wireways and Enclosures—Featured in 16-pp Catalog 159-D is a complete line of wireways, fittings and enclosures designed for applications where wiring must be protected against dirt, dust, oil, water and coolants. Includes dimensional drawings and detailed specifications. Keystone Mfg. Co.

For a copy, circle 174 on Post Card

Silicone Rubber Insulation—Advantages and characteristics of silicone rubber insulated wire and cable are detailed in this 6-pp product bulletin. Typical applications are listed. Dow Corning Corp.

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SAFETY, PLANT PROTECTION

Safety Glasses—Safety advances built into company's line of glasses for eye protection are outlined in this 10-pp product bulletin. Illustrations of various types of safety glasses are included. American Optical Co.

For a copy, circle 176 on Post Card

Eye, Face Protection—Selection information on eye and face protection for a wide variety of industrial applications is presented in 40-pp Catalog 0300-1. Equipment covered includes spectacles, vision testing equipment, goggles, faceshields, welding helmets. Mine Safety Appliances Co.

For a copy, circle 177 on Post Card

Industrial Apparel—Described in this 16-pp catalog is a line of acid resistant, lint-free and static-free apparel designed for industry's varied requirements. Included with the catalog is a handy swatch card of actual fabric samples. Worklon, Inc.

For a copy, circle 178 on Post Card

Plant Protection—This 30-pp pocket-sized handbook on property protection covers all aspects of guard selection, training and procedure, uniforms and equipment, the guard's route, etc. Safety and fire checking, first aid, intruders, sprinkler systems and report writing are also covered. Detex Watchclock Corp.

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Fire Venting—Eight-pp Bulletin FY-R59 describes fire vents and how they reduce destructive effects of fire. Vent designs to meet various requirements covered, fire hazard rating charts included. Penn Ventilator Co., Inc.

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STORAGE TANKS

Steel Storage Tanks—Design and application of elevated steel tanks for water storage are described in this 20-pp illustrated bulletin. Features spheroidal, radial cone and ellipsoidal tank designs and includes photos of typical installations. Chicago Bridge & Iron Co.

For a copy, circle 181 on Post Card

Storage Water Tanks—Three types of protective linings available in these storage hot water tanks are described in 8-pp Bulletin BH-2N. Selection tables and detailed specifications, design and construction data included. The Sims Co., Inc.

For a copy, circle 182 on Post Card

HEATING AND COOLING

Industrial Heaters—Illustrated and described in this 12-pp bulletin are industrial heaters for unit heater or central applications. Typical installations are pictured, construction and operating features shown on cutaway and engineering data and specifications included. Lennox Industries Inc.

For a copy, circle 183 on Post Card

Tank Heaters—Described in 8-pp Bulletin 300 are three types of tank heaters—vertically mounted, horizontally mounted and immersion type heaters. Applications, dimensions heating surface and other data included. Brown Fintube Co.

For a copy, circle 184 on Post Card

Heating-Cooling Coil Uses—Applications of single and double embossed Panelcoil for heating and cooling are illustrated and described in Data Sheets M12 and M13. Shows applications on storage and processing tanks, drums, troughs, ovens, other equipment. Dean Products, Inc.

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Heat Exchangers—Detailed information on heat exchangers for a variety of commercial and industrial hot water heating applications is presented in 24-pp Catalog 601. Includes construction details and engineering data, selection charts for all types of converters and instantaneous heaters, both steam to water and water to water heat transfer. Old Dominion Iron & Steel Corp.

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Heat Transfer Equipment—Bulletin 800 summarizes company's heat transfer equipment, including double pipe heat exchangers, fired indirect heaters, tank heaters, tank suction and line heaters, process heaters and coolers, gas cooling and heating equipment, and custom built equipment. The Brown Fintube Co.

For a copy, circle 187 on Post Card

FILTERING

Self-Cleaning Filters—All metal edge-type filters which do not require cartridge replacement are illustrated and described in 16-pp Catalog 51-100. A cutaway view is provided to demonstrate self-cleaning action, as well as a selector chart and flow tables. The Cuno Engineering Corp.

For a copy, circle 188 on Post Card

Vertical Leaf Filters—Eight-pp Bulletin 150 describes vertical leaf pressure filters for clarifying solutions and recovery of solids. Operating principle is covered, and diagram showing arrangement of leaves is included, along with detailed specifications. T. Shriver & Co., Inc.

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Compressed Air Filter—Illustrated and described in 8-pp Bulletin 6000 is a compressed air filter designed to remove dirt, oil and water from compressed air lines. Diagram showing operation, specifications, mounting dimensions and other data included. King Engineering Corp.

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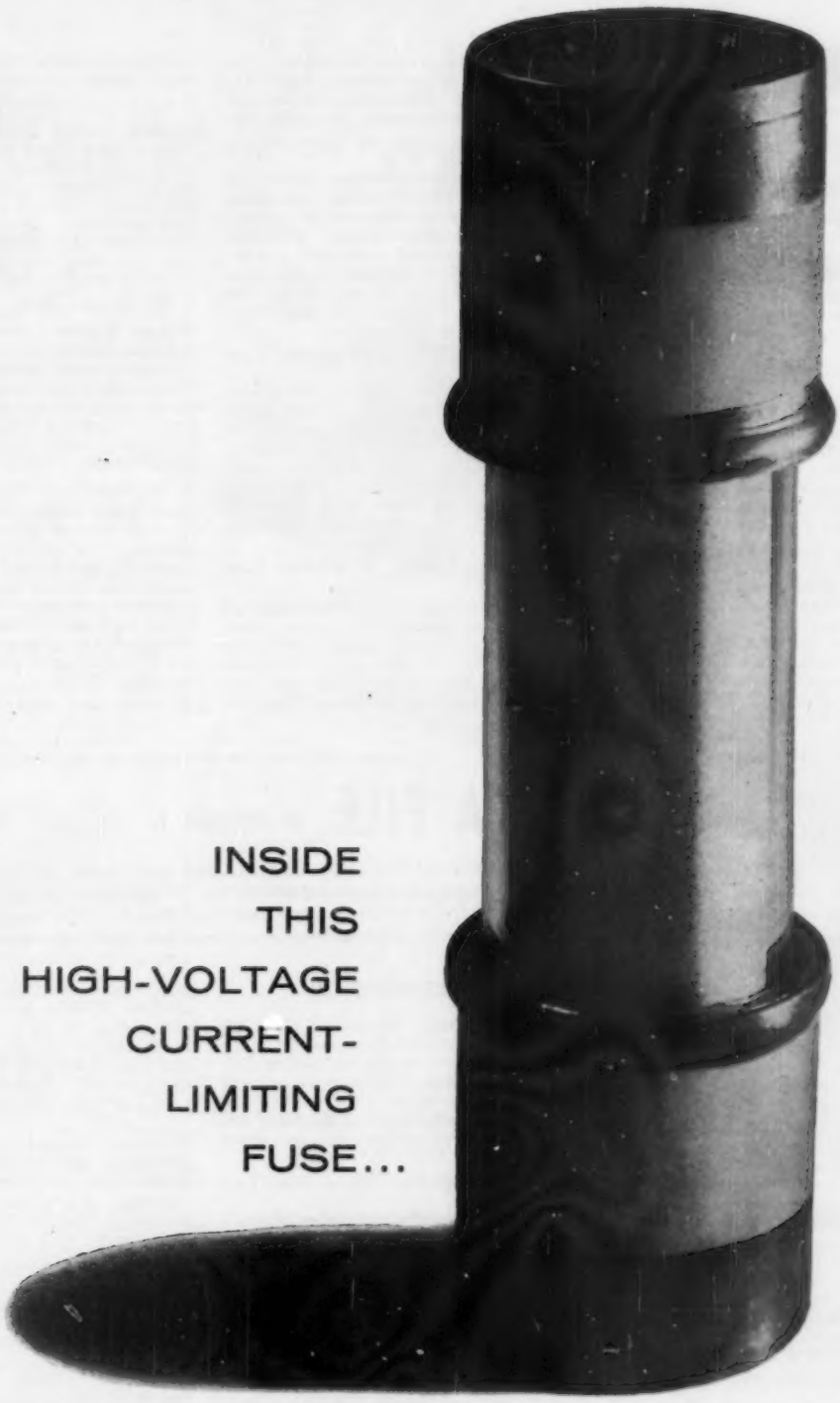

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Damaging currents are choked out in ½ cycle

Inside General Electric high-voltage current-limiting fuses, damaging short circuits are limited to harmless levels and choked out in ½ cycle or less to prevent damage to protected equipment.

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General Electric high-voltage current-limiting fuses are sure to meet your application requirements—indoors or outdoors—for protection of capacitors, motors, transformers, load centers, feeder circuits, and for general purpose duty. They're available in all standard voltage ratings from 600 to 34,500; and in a range of amperage ratings designed to meet any need.

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For more facts circle 622 on Reply Card

BULLETINS

(Begins on page 23)

OTHER EQUIPMENT

Steam Generators—Automatic packaged steam generators are featured in 18-pp Bulletin AA 2760. Analysis of boiler design factors is included along with detailed performance data, photos and a longitudinal section showing generator components. Ames Iron Works, Inc.

For a copy, circle 191 on Post Card

Elastomeric Seals—This 12-pp bulletin describes a line of elastomeric seals called Tetraseals designed to seal across two opposite faces of a rectangle. Applications are detailed and dimensional data tabulated. Goshen Rubber Co., Inc.

For a copy, circle 192 on Post Card

On Mounting Tubing—This 76-pp Engineering Design Manual (Bulletin 212 G) offers a compiled listing of materials and specifications, recommended application and latest technique for mounting tubing, wiring and similar hardware. Also includes description of complete line of clamps, brackets, shims.—TA Mfg. Co.

For a copy, circle 193 on Post Card

Parking Barriers—Basic parking lot plans and parking equipment are shown in Bulletin 14A. Illustrates five plans for parking at various angles, and describes various wheel-stopping type barriers. Harris-Barrier, Inc.

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Grate Magnets—Described in 6-pp Bulletin B-44 is a complete line of permanent, non-electric magnetic grates designed to assure product purity and protect against machinery damage caused by iron contamination. Specification tables and diagrams are included. Eriez Mfg. Co.

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Hardness Testing—Catalog RT-60 contains 24 pp of data designed to aid in selection of hardness of testing equipment. Illustrates and describes fully automatic models, motorized models, those for testing at elevated temperatures, internal hardness testing, mobile testing, penetrators for testing hardened steel, accessories. Wilson Mechanical Instrument Div., American Chain & Cable Co., Inc.

For a copy, circle 196 on Post Card

Flexible Metal Hose—Detailed information on all-metal flexible hose to convey gases, solids and fluids, for vibration control, and to compensate for motion or misalignment under high temperature, pressure, vacuum or abrasive conditions is presented in 20-pp Catalog ID-100D. Specifications and application photos, together with coupling recommendations are included. Universal Metal Hose Co.

For a copy, circle 197 on Post Card

Filters, Regulators, Lubricators—Engineering and application data on compressed air preparation units—filters, regulators and lubricators—is presented in 20-pp Bulletin 0400-B1. Diagrams and dimensional drawings and tables are included. Hannifin Co.

For a copy, circle 198 on Post Card

Seamless Welding Fittings—Eight-pp Bulletin FB-502A covers seamless welding fittings and flanges in carbon, alloy and stainless steels. Includes charts of standard sizes and schedules, dimensional tolerances, illustrations of commonly produced fittings and flanges. Tubular Products Div., The Babcock & Wilcox Co.

For a copy, circle 199 on Post Card

High Temperature Alloys—Comparative data on properties of company's high-temperature alloys is presented in this 20-pp bulletin. Compares physical, mechanical, chemical properties, and stress rupture data of alloys in various forms, such as sheet, bar, sand and investment castings. Haynes Stellite Co.

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Anion Exchangers — Advantages of porous type highly-basic, quaternary amine polystyrene exchange resins for silica removal in individual or mixed bed demineralizing plants are discussed in this 8-pp bulletin. Contains flow charts, tables and other illustrations. Ionac Chemical Corp.

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Cooling Tower Deterioration—Causes, symptoms and suggested cures for deterioration of wood in cooling towers are described in 8-pp Reprint 85. Covers principle types of deterioration — leaching, delignification, and microbiological attack — and tells how they can be discovered by inspection. Nalco Chemical Co.

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Weight Tables—This 16-pp bulletin contains tables for computing weight of welded steel tubing. Gives dimensions and weight per foot for round mechanical tubing to 10 in., square and rectangular tubing to 5 in., and pressure tubing to 5 in. Jones & Laughlin Steel Corp.

For a copy, circle 203 on Post Card

Hose Style Guide—Twelve-pp Bulletin 627 serves as a guide for hose selection for all types of industrial applications. Listed are 112 liquids and gases—from acetate solvents to zinc salt solutions—and the suitability of various tubestocks for carrying these agents is charted as excellent, good, conditional and unsatisfactory. Aeroquip Corp.

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DATA FILE of literature for the plant engineer's library

STANDARD CATALOGS, bulletins and handbooks are listed to help plant engineers maintain a permanent data file. To get these free catalogs, circle item numbers of those wanted on postage-free cards provided on pages 227 and 228.

CONSTRUCTION

Intrusion Piling—Described in 20-pp Special Report 102 is a cast-in place piling service using intrusion-prepacked concrete piles. Advantages of the cast-in-place piling are detailed, and typical construction projects are illustrated and described. Intrusion Prepakt Inc.

For a copy, circle 301 on Post Card

Piling Service—Details on company's piling rental system are presented in 24-pp Catalog 400. Includes complete data giving sizes and physical characteristics, dimensional profile drawings, correct applications for all sections including corners and connections and illustrations of different types of foundations and cofferdams. L. B. Foster Co.

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Open Web Joists—Standard and long span open web steel joists are illustrated and described in this 38-pp catalog. Advantages of the steel joist construction are detailed, and sections are included on design calculation, properties and dimensions. American Bridge Div., United States Steel Corp.

For a copy, circle 303 on Post Card

Screw Fastening of Aluminum—This 48-pp technical handbook covers various types of standard and special fasteners and fastening systems used to join aluminum assemblies. Supplemented with numerous illustrations and tables, it includes list of manufacturers of special screw fasteners and recommended hole sizes for various screws. Reynolds Metals Co.

For a copy, circle 304 on Post Card

Aluminum Sash—Illustrated and described in this product sheet is rigid welded sash made from aluminum extrusions. Advantages are listed and sectional details pictured. Aluma-Sash Corp.

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Joint Sealant—Circular 53 describes a waterproof joint sealant that bonds permanently to a variety of building materials. Advantages are detailed. aplication method given. Standard Dry Wall Products, Inc.

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Decorative Protective Panels—Advantages of Security Panel, a combination of steel mesh and polyester resin translucent panels are detailed in this bulletin. It features high dimensional stability, high impact strength and protective functions. Installation and technical information are covered. Resolite Corp.

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Insulating Panels—This 28-pp Manual 3766 contains application information

and design data on Asbestone Panels for interior and exterior construction. Includes general information on construction and characteristics of panels, design data, sizes, erection of partitions, and specification data, and is profusely illustrated with drawings and diagrams showing details. National Gypsum Co.

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Structural Clay Products—Descriptive information, photos and construction details on structural clay building materials are presented in 24-pp Catalog S-60. Characteristics and advantages of various types of facing tile, bricks, and other products are detailed, and color-photos of installations included. Natco Corp.

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Functional Glass—Advantages of company's rolled, figured and wired glass for vertical sidewall and skylight glazing are detailed in Catolog 60-G, 20-pp. Describes types suited for commercial, institutional, industrial applications. Provides properties. Mississippi Glass Co.

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Acrylic Plastic Sheet—This 12-pp Booklet PL-415 describes properties and characteristics of Plexiglas acrylic plastic sheet. Applications in a variety of industries are illustrated. Rohm & Haas Co.

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Basic-Roofing Information—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses roofing practices. Johns-Manville.

▲ For a copy, circle 312 on Post Card

Sliding Fire Doors—Design and construction features of sliding fire doors are detailed in Form DHSL-60. Cutaway diagram illustrating construction details is included, as well as suggested specifications. Dusing and Hunt, Inc.

▲ For a copy, circle 313 on Post Card

Cold Storage Doors—Detailed information on company's power-operated and hand operated cold storage doors is presented in Catalog 260. Installation and specification data included. Clark Door Co., Inc.

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Cold Storage Doors—Advantages of company's Electroglide electric horizontal sliding doors for cooler and freezer operation are detailed in this 6-pp bulletin. Describing design and operation features, it also includes table of sizes, space requirement diagrams, and installation data. Jamison Cold Storage Door Co.

▲ For a copy, circle 315 on Post Card

Corrosion-Proof Flooring—Bulletin 120-A describes a monolithic corrosion-proof flooring material developed for application over concrete to protect against acids, alkalis and solvents. The Ceilcote Co., Inc.

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LESS DOWNTIME!

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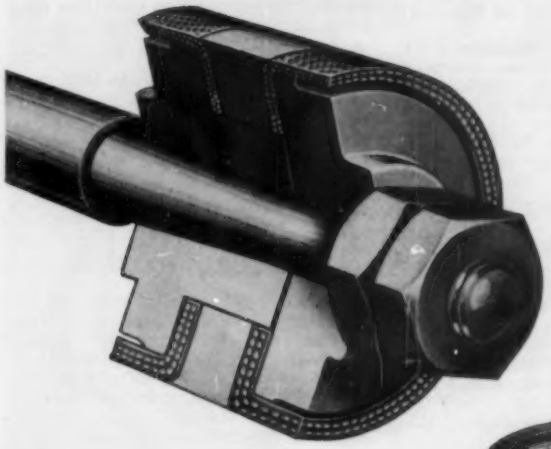

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And because fewer replacements are necessary, you have less downtime. Users report that Pumcups *outlast ordinary packings at least 3 to 1!*

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For more facts circle 623 on Reply Card

DATA FILE

(Begins on page 232)

Steel Floor Plate—Features and advantages of rolled steel floor plate are detailed in this Product Form 3184. Table of dimensional data is included, as well as illustrations of installations. Alan Wood Steel Co.

▲ For a copy, circle 317 on Post Card

Gratings and Treads—Bulletin 1110, 24-pp, describes welded, serrated, pressure-locked, steel, vault, platform and aluminum grating in standard and close spacing types. Stair treads are also shown. Provides tread weights, and ordering instructions. Safe loads also given. Dravo Corp.

▲ For a copy, circle 318 on Post Card

Steel Grating—Design features and advantages of electronically welded steel grating and treads are detailed in this 12-pp bulletin. Engineering data includes tables of safe loads, weights, conversion factors, and specifications. Kerrigan Iron Works Co.

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On pages 227-228 are two postage-free Reader Service Cards provided for your convenience in ordering these bulletins. You may also use the cards to order any literature mentioned in the ads.

Safety Floor Plate—Advantages of Multi-grip floor plate designed for sure footing and positive traction under all conditions are detailed in 15-pp Bulletin ADUCO-17002-59. Tables list available sizes, thicknesses and weights, and show allowable uniform loads for various plate thicknesses and spans. U. S. Steel Corp.

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Safety Grating—Steel, aluminum and stainless steel safety grating for a variety of industrial applications is featured in illustrated 24-pp Catalog 5911. Shows typical installations, and includes complete engineering data for erection, as well as load charts. The Globe Co.

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Stair Treads, Grating—Details on company's aluminum stair treads and grating featuring one-piece construction are presented in this Product Bulletin AD-679. Describes types of finishes, sizes and weights available, and includes specifications. Aluminum Co. of America.

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LUBRICATION

Lubricant Data—Characteristics, advantages of company's line of specialized fluid and grease type lubricants are described in 32-pp Data Book 59-2. Includes sections on control of friction, use of grease type lubricants, proper applications, and recommendations for various operating conditions. Lubriplate Div., Fiske Brothers Refining Co.

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Organized Lubrication—Benefits of organized lubrication—major cost control factors are extolled in this 24-pp bulletin. Cost control opportunities are detailed and the task of assigning responsibilities and delegating authority are covered. Texaco, Inc.

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Lithium Base Grease—Featured in this 12-pp booklet is a multi-purpose lithium base grease designed to do the work of many. Characteristics of the grease under different types of conditions given. Gulf Oil Corp.

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MATERIALS HANDLING

Conveyor System—Construction and operating features of company's Power-Flex and free conveyor system for industry-wide application are illustrated and described in 6-pp Bulletin 159. Advantages are detailed and general specifications given. Conveyor Div., Columbus McKinnon Corp.

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Continuous Vertical Conveyor—Bulletin 125 describes features and advantages of the Escaveyor, a continuous vertical conveyor designed to speed lifting and lowering. Schematic diagrams suggest some of the conveyor systems, for both horizontal and vertical continuous flow, that can be made from the units. Standard Conveyor Co.

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Vibrating Conveyors—Advantages and features of vibrating conveyors are detailed in 16-pp Catalog 66. Layouts and flow charts showing how conveyors can be designed to perform a wide variety of processing operations at the same time the material is being conveyed are included. Ajax Flexible Coupling Co., Inc.

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Portable Electric Hoists—Eight-pp Bulletin 15010 describes push button or pull cord control portable electric hoists. Cutaway views showing component features are included, as well as price data. Manning, Maxwell & Moore, Inc.

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MH Equipment Selector—Sixteen-pp Condensed Catalog 80-204 describes and illustrates manufacturer's line of materials handling equipment. Offers specifications and illustrations on rider fork lift trucks, rider tractors, narrow aisle rider electrics, electric powered walkies and manual equipment. A selector chart shows types. Lewis-Shepard Products Inc.

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Cost-Cutting Materials Handling—"The How Book of Cost-Cutting Materials Handling," is a 24-pp booklet covering various phases of the materials handling problem and their effect on industrial production. Text and pictures cover such subjects as fundamental handling motions, advantages of planned material handling practices. The Yale & Towne Mfg. Co.

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Mechanical Jacks—Mechanical Catalog 60 contains 16 pp of information on mechanical jacks and pullers, including ratchet lowering lever jacks, track jacks, journal, bridge, screw, push-and-pull jacks, special purpose equipment, accessories. Includes specifications. Templeton, Kenly and Co.

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Industrial Casters—Catalog 159 contains 24-pp of illustrations, descriptions and specification data on swivel-plate and rigid-plate truck casters for industrial applications. Includes detailed information on spring-action casters, V-groved casters, grease-sealed casters, scaffold casters, floor truck locks, industrial wheels, and others. Faultless Caster Corp.

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Self-Dumping Hoppers—Cost-saving advantages of self-dumping steel hoppers for bulk material handling are detailed in Bulletin 265. Photos showing typical handling applications are included. Roura Iron Works, Inc.

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STORAGE, SHOP EQUIPMENT

Guide to Shelving—To assist plant engineers in selecting proper shelving for all storage requirements, 64-pp Cotalog 30 offers detailed suggestions for correct shelving and storing materials, loose and packed parts. Storage cabinets are also described and instructions included for planning of stockrooms. Deluxe Metal Products Co., Royal Metal Mfg. Co.

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Steel Equipment—Catalog 100 H contains 92-pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Includes dimensions and specifications. Lyon Metal Products, Inc.

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Storage Racks—Bulletin R-400, 12-pp, illustrates and describes a wide variety of storage racks manufactured by the company. Application drawings, photos and diagrams are included. Chicago Tramrail Corp.

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PUMPS AND COMPRESSORS

Centrifugal Pumps—Bulletin 720.4 gives data on materials of construction, performance curves and dimensions of full line of single stage, end suction, open impeller centrifugal pumps, 13 sizes, 1¼-in to 8-in. capacities to 3000 gpm, and heads to 180 ft. Goulds Pumps, Inc.

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Condensation Pumps—Eight-pp Bulletin 1403 describes company's line

of condensation pumps for use in low and medium pressure-heating systems and steam-process equipment. Photos, drawings and other technical data on capacities and dimensions pertaining to construction, application and installation given. Dunham-Bush, Inc.

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Nuclear Pumps—This bulletin describes centrifugal pumps for all types of nuclear pumping applications. Three basic types are covered—liquid metal, liner-motor and mechanically-sealed pumps, with general description and capacity ratings. Byron Jackson Pumps, Inc.

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Quiet Operating Pumps—Described in Bulletin 18-958 are pumps designed for noiseless operation in circulated water heating and cooling systems. Capacity and dimensional data included. Bell & Gossett Co.

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Multi-stage Pumps—Illustrated and described in 12-pp Bulletin 980 is a line of single suction multi-stage pumps hydraulically balanced for high efficiency. Sectional drawings, specifications, dimensions and general data are included. Buffalo Pumps Div., Buffalo Forge Co.

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Water-Cooled Compressors—Featured in 12-pp Bulletin WB10 are two-stage water-cooled air compressors designed to meet the demand for small machines having efficiencies comparable to those of large two-stage horizontal compressors. Cutaway views showing component features included. Gardner-Denver Co.

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Rotary Air Products—Features and advantages of company's rotary air products, including air motors, air compressors, and vacuum pumps,, are detailed in 12-pp Catalog 660. Performance curves are included, along with tables of engineering data, dimensional drawings. Gast Mfg. Corp.

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Oil-Free Compressors—Described in Bulletin 351 are compressors designed to compress air or gas entirely free of any oil or oily vapors due to lubricants. A large cutaway view illustrates component features. Pennsylvania Pump and Compressor Co.

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Air Compressors—Design and construction details on company's semi-radial air compressors are presented in 24-pp Bulletin A-72. Illustrates semi-radial construction which results in better balance, less weight, and quick installation, and includes specification data. Joy Mfg. Co.

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Unit-Type Compressors—Again available to power engineers is 12-pp Bulletin 8G-2 on unit type compressors. Illustrated in color, this bulletin uses photos and cutaways to describe single- and two-stage compressors from ½ to 15 hp, available pressures from 80 to 250 psi. Specifications list cfm displacements, pressures, weights,

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New 316 stainless series (series 1936) is identified by blue handle. Sizes from ¼" to 1"; globe, angle, and panel mounted patterns.

Marsh Needle Valves are also available in 416 stainless steel (identified by green handles) and in alloy steel (identified by yellow handles).

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Division of Colorado Oil and Gas Corporation
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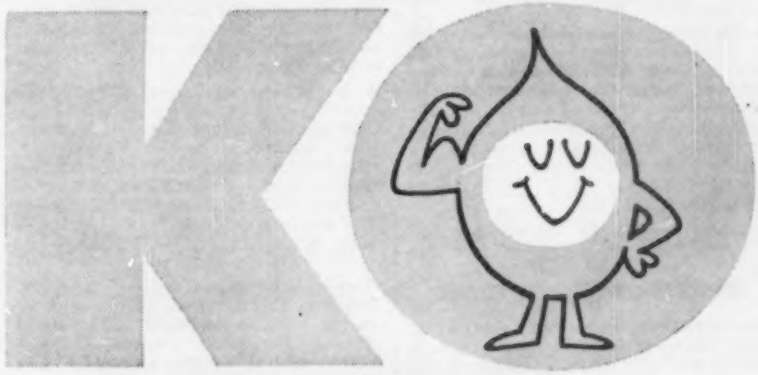

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DATA FILE

(Begins on page 232)

dimensions and rpm. Le Roi Div., Westinghouse Air Brake Co.

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Compressor Data—Feather valve compressors from 75 to 350 hp are described in 32-pp Bulletin 3620-B1. Advantages on installation, operation and maintenance costs are outlined for types YC and DYC compressors. Information and illustrations are offered on component parts, including frame, running gear parts, intercooler, crosshead, motor and main bearings and various cut-away views are included. Worthington Corp.

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PACKINGS, SEALS, GASKETS

Mechanical Packings—Featured in 24-pp Catalog 60 are several recent packing developments including the multi-purpose Bel-Vee V-Ring packings, the long wearing crisscross braid packing series, twisted foil packings for oil and distillate temperatures to 1000 F, and an Inconel-wire reinforced plastic packing for valves handling superheated steam at temperatures up to 800 C. The Belmont Packing & Rubber Co.

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Piston Packing—Sixteen-pp Bulletin 5903 presents engineering data on Darcova Pumcups for packing pistons of air cylinders, hydraulic cylinders and reciprocating pumps. Included are operating diagrams and a list of typical installations, as well as helpful data on Pumcup compositions. Darling Valve & Mfg. Co.

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Impregnated Felt Gasketing—Featured in this product bulletin is TFE-fluorocarbon impregnated felt for gasketing under extreme conditions. Properties and uses of Armalon are detailed and table of physical properties is included. E. I. Du Pont de Nemours & Co., Inc.

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INSTRUMENTS, CONTROLS

Controls for Automation—Automation Controls Catalog 44-pp, groups together a wide selection of automatic controls most commonly used in designing automatic systems. Includes such items as counting devices, switches, electric valves, actuators, relays, limit controls, time switches and accessory equipment which can be used as building blocks in selecting components for tailoring system. General Controls Co.

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Meters, Regulators, and Valves—Bulletin C-5000, 28-pp, describes and illustrates meters, regulators and valves for a wide range of services. They include gas meters, gas pressure regulators, industrial meters, water meters. Information includes application suggestions, specifications and references to more detailed product literature. Rockwell Mfg. Co.

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Data System—This 12-pp Illustrated Brochure MSP-161 outlines construction and operation of an all electronic data system for logging, monitoring, computing and optimizing control. Technical data is provided on all functions of the equipment, including inputs, d-c amplification, analog-to-digital conversion, linearization, programming, integration, computer control and others. Hagan Chemicals & Controls, Inc.

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Gages, Needle Valves—Catalog 76-G consists of a loose-leaf bound collection of literature on gages and needle valves. Various types of gages are illustrated and described, with applications and specifications fully detailed. Jas. P. Marsh Corp.

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Electronic Instruments—Illustrated and described in this 12-pp product bulletin are electronic and electromechanical instrument systems. Descriptions of products and services are given, with examples of the indicating and control systems designed for industrial and other applications. The Liquidometer Corp.

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VALVES, PIPING, FITTINGS

Choosing the Right Valve—Importance of choosing the right valve is stressed in this 20-pp Bulletin AD-2016. Describes three principal valve types—gate, globe and check valves—their design and service characteristics, lists names of valve parts, describes disc-stem connection, bonnet and bonnet-joint characteristics, materials. Crane Co.

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Corrosion-Resistant Valves—Bulletin V-4b describes corrosion resisting valves with Teflon sleeves. Details of construction are illustrated and valve dimensions and other data tabulated. The Duriron Co., Inc.

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Corrosion-Resistant Valves—Eight-pp Bulletin 11 describes stainless steel valves with replaceable Teflon discs or seats for corrosive services. Illustrates globe, Y, check, needle and plug gate designs, as well as some with complete jacketing. Specification and application data provided. Alloy Steel Products Co., Inc.

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Sliding Gate Valves—Features of sliding gate diaphragm control valves are illustrated and described in 8-pp Bulletin J170-1. Includes information on applications, capacities, dimensions, operating characteristics, materials of construction, as well as specifications. OPW-Jordan Corp.

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Stainless Steel Valves—Corrosion resistant stainless steel valves are featured in 32-pp Catalog 59SS. Features of design and construction are shown through cutaway views, and advantages of stainless steel in withstanding corrosive chemicals and atmospheres detailed. Jenkins Bros.

For a copy, circle 378 on Post Card

On Steam Traps—Catalog K is an enlarged 48-pp manual and steam trap catalog. New material provided includes open float and thermostatic traps, pipe strainer to 6 in. steel and semi-steel, and helpful steam pipe sizing tables. Discusses fundamentals of good trapping, trap selection, installation. Armstrong Machine Works.

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Glass Drainline System—Twelve-pp Bulletin PE-30 describes Pyrex brand drainline system for disposal of corrosive wastes. Contains product and property data, information on making joints and hanging, and list of available fittings, as well as schematic drawings, tables and specifications. Corning Glass Works.

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Continuous Weld Pipe—Fabrication of continuous weld pipe from the smelting of the iron ore to the rolling of steel is pictured and described in this product bulletin. Includes tables of dimensional data, weights and test pressures. Wheeling Steel Corp.

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Valved Couplings—Features and applications of company's valved couplings designed for instant shut-off are detailed in Bulletin H-1686. Covers couplings for high pressure, vacuum and very low pressure, for impact air lines and for hard to handle fluids. Snap-Tite Inc.

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BOILERS, GENERATORS

Bent Tube Boilers—Design and operation features of company's bent tube boilers for power, processing or heating are detailed in 22-pp Bulletin VF-VS-2. Boiler sections of typical installations and principal data on each are included. Henry Vogt Machine Co., Inc.

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Automatic Boilers—How Continental automatic boilers are designed to offer reliable and economical operation is discused in Form BE 400. Stresses advantage of two-pass design; describes burners, controls. Boilers covered include 20 to 600 hp steam boilers, hot water and HWT boilers, for oil-, gas, or combination fuel. Dimensions tabulated. Continental Boiler Div., Boiler Engineering & Supply Co., Inc.

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Hot Water Boilers—Catalog HCC-2, 20-pp describes and illustrates design, construction advantages and economies of company's controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process use. Combustion Engineering, Inc.

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HEATERS, HEATING

Space Heaters—Counterflo heaters, designed to deliver maximum Btu output to air at the point of use, are described in Bulletin 580, 6 pp. Engineering data given. Dravo Corp.

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Hot Water System—How to provide hot water for the variety of requirements of an industrial plant without stretching the hot water system too far is the problem covered in this series of ring-bound bulletins. Various types of water heaters for commercial and industrial applications are illustrated. A. O. Smith Corp.

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TOOLS, WELDING AND MACHINE SHOP

Industrial Tools—Information on a complete line of industrial tools, including 500 new types and sizes never before offered, is presented in 120-pp Catalog 57. Included are complete lines of wrenches, socket wrenches, drop forged clamps, tool holders, set up and hold down tools, cutting tools provided. Armstrong Bros. Tool Co.

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Pipe Tools—Ordering and application information on Rigid pipe tools is provided in 16-pp illustrated Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises, and others are pictured and described, also power drives. The Ridge Tool Co.

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Welding Flux Recovery—This bulletin tells how company's equipment salvages unused flux from submerged arc welding, removes powder and returns slag-free, dust-free flux to welder in a continuous flow. Dimensions and specifications are given for extensive line of stationary, portable models. Invincible Vacuum Cleaner Mfg. Co.

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Data for the Shop—"Fluids and Facts for Metal Working" is a pocket-size booklet of about 44-pp. A section on metal working fluids covers their function and selection, preparation and use of soluble oil and paste compounds, and prevention of dermatitis. Conversion tables, steel numbering systems, machinability ratings. Standard Oil Co. (Ind.)

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MAINTENANCE

Painting Economy—This 12-pp guide to economical maintenance painting is designed to help reduce cost of painting in industrial, institutional and commercial buildings. Outlines three basic areas of painting economy. Barreled Sunlight Paint Co.

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Coating Systems—Described in this 16-pp bulletin are a number of protective maintenance coating systems designed to solve a variety of corrosive problems. Index tab indicates where a particular system should be

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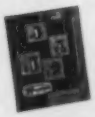

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DATA FILE

(Begins on page 232)

applied, and copy explains features of each system. The Glidden Co.

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Industrial Vacuum Cleaning—Twelve-pp Bulletin 155 B describes both stationary vacuum cleaning equipment and portable industrial vacuum cleaners, the latter in both light and heavy-duty types. Recent improvements in collection and dumping methods are also covered. Spencer Turbine Co.

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Vacuum Cleaning Equipment—Suction cleaning equipment designed to meet all dust and dirt removal operations, wet and dry, is featured in a series of product bulletins. Detailed specifications are included, along with photos of typical applications. The National Super Service Co.

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SAFETY, SANITATION

Fire-Resistant Fluids—This series of specification sheets describes company's line of fire-resistant fluids including synthetic, oil-in-water and water-in-oil emulsion and glycol types. Physical characteristics given. Mobil Oil Co., Inc.

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Handling Flammable Liquids—Problems involved in the use of flammables in individual processes, and methods and equipment required for safe control are described in this 76-pp safety handbook. Physical properties and characteristics of most commonly used flammables are detailed; recommendations for safe handling given. The Protectoseal Co.

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Engineered Maintenance—This booklet tells how to control costs, improve efficiency and save management time in sanitary maintenance. Tells what an engineered maintenance program includes, how it is prepared, advantages afforded. Puritan Chemical Co.

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Waterless Washstation—This large fold-out brochure illustrates and describes advantages of company's waterless washroom unit for hand washing on the job. Describes the waterless skin cleanser used, as well as the dispenser and waste receptacle. Sugar Beet Products Co.

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ELECTRICAL

Distribution Transformers—Dry type distribution transformers, single and three phase, are featured in 16-pp Bulletin 5A2-BL01. Wiring diagrams and detailed specifications are included. Acme Electric Corp.

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Single-Phase Motors—Bulletin 470-B describes integral horsepower single-

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phase motors, ¾ to 20 hp, in open, protected, totally enclosed fan-cooled and explosion proof frames. Bulletin outlines company's "weatherizing" treatment which makes motors suitable for use in damp, dirty or corrosive atmospheres. Motor Div., Robbins & Myers, Inc.

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Secondary Unit Substations—Detailed information on secondary unit substations—complete and compact load distribution centers for indoor or outdoor application—is supplied in 24-pp Bulletin 3104-1A. Contains data and specifications on a large variety of primary devices, transformers etc. I-T-E Circuit Breaker Co.

▲ For a copy, circle 414 on Post Card

Electrical Controls—Featured in this 80-pp Bulletin LO-11 is a line of electrical control equipment, including safety switches, service control, load centers, and accessories. Describes design and construction features, and includes detailed selection tables and case dimensions, wire tables. Cutler-Hammer Inc.

▲ For a copy, circle 415 on Post Card

Control Centers—Advantages of centralized controls are detailed in this 16-pp Bulletin PL-6200. Photos and text describe construction and electrical features of company's control centers, details on magnetic starters, and bulletin includes space requirements tables, plan-it-yourself data. The Clark Controller Co.

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Motor Control—Commonly used motor control equipment is featured in this 42-pp product bulletin. Lists prices, dimensions and ratings for all types of switches, starters, relays, contactors, push button stations, pressure controls, terminal blocks and other items. Allen-Bradley Co.

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Metal Raceways, Fittings—Catalog and Wiring Guide 22 contains 152-pp of data on surface metal raceways and fittings, multi-outlet assemblies, and lighting equipment. Included is a section on National Electrical Code as it affects company's product, including tables of capacities, as well as installation and application information and installation photos. The Wiremold Co.

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Battery Technology—Bulletin GB-1896 is a 36-pp handbook of technical instructions and engineering data on the care of motive power storage batteries. Covers all phases of lead acid battery theory, operation and maintenance. Provides basic information on specific gravity changes, charging cycles. Gould-National Batteries, Inc.

▲ For a copy, circle 419 on Post Card

Renewable Fuses—The first section of 12-pp Bulletin 1320, discusses construction and application features of two types of renewable fuses—ferrule and knife-blade—as well as renewal links to facilitate replacement. Salient features are highlighted by sectional and cutaway drawings. Ordering information and specifications of the 250-v and 600-v fuses are covered in the second section. Federal Pacific Electric Co.

▲ For a copy, circle 420 on Post Card

Electrical Equipment Digest—Electrical equipment illustrated and described in 168-pp Catalog Digest No. 143, includes load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.

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Electrical Equipment—Collected in this bound catalog is a series of bulletins on company's line of electrical equipment including electric motors, generators, motor-generator sets, switchboards and controls. Cutaway views showing details of design and construction are included. The Ideal Electric & Mfg. Co.

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Adjustable Autotransformers—Continuously-adjustable autotransformers are illustrated and described in Bulletin 424. Detailed specifications and arrangement diagrams are included. General Radio Co.

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Sheathed Cable—Construction details and performance dota on company's sheathed cable, available in steel, copper, aluminum and bronze, are presented in 16-pp bulletin 1031. Complete engineering data, installation

NEW!

REGULATORS AND CONTROL VALVES NOW AVAILABLE IN DUCTILE IRON

This easy to use manual describes how you can get steel strength in regulators and control valves at the cost of iron . . . and, at considerable savings. It fully explains how ductile iron is produced, shows features, specifications, typical ranges of mechanical properties, and comparison tables on physical properties of cast steel, ductile iron, red brass and cast iron. This manual is also a condensed catalog describing the complete line of OPW-JORDAN products that are available to you in ductile iron. DI-1

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DATA FILE

(Begins on page 232)

information and test results included. Simplex Wire and Cable Co.

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Safety Mineral Insulated Cable—Bulletin S-2-60, 20-pp, describes cable properties, applications, installation procedure, construction and performance characteristics, electrical, and mechanical properties and wiring specifications of mineral insulated cable recommended for hazardous locations. Mineral Insulated Wire Div., General Cable Corp.

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Electrical Metallic Tubing—Product uses, features and manufacturing processes of electric metallic tubing are detailed in 12-pp Bulletin RCP-900. Recommended applications are outlined, and charts are included which detail number of cables each size accommodate. Rome Cable Div., Aluminum Co., of America.

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MECHANICAL POWER TRANSMISSION

Stock Chains, Sprockets—Listed in 44-pp Book 2757 are stock sizes of this company's roller chains and sprockets available for immediate delivery in major industrial areas. Key indexed for easy reference, book presents 2000 types and sizes including standard and double pitch power transmission chains, conveyor chains and attachments and sprockets. Link-Belt Co.

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Screw Conveyor Drives—Bulletin 7106 presents 20 pp of data on screw conveyor drives for applications in range from ½ to 30 hp, in four ratios, designed to bolt to standard trough ends. Design features and accessories are described, selection and dimensional data included. The Falk Corp.

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V-Belt Drives—Tips on getting the most from your V-belt drives are presented in 12-pp Bulletin DH-833. Benefits of a good maintenance program are detailed, and sections on selecting V-belts, installing V-belts, drive inspection and maintenance, and V-belt drive analysis chart included. The Gates Rubber Co.

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Variable Speed Belts—Detailed information on company's variable speed belts made with arched construction for improved transverse rigidity is presented in Product Bulletin 862. The Goodyear Tire & Rubber Co.

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Grommet V-Belts — Advantages of company's grommet V-belts are illustrated and described in this 8-pp bulletin. Belt features are fully described and tips on how to figure a V-belt drive given. Goodall Rubber Co.

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Spring Clutches—Described in this 30-pp catalog are five standard lines of spring clutches in bore sizes from ⅛ to 1 in., torgue capacity to 1250 lb-in., for use in applications utilizing drive up to 5 hp. Clutches offered include over-running and back-stopping; indexing; on-off; on-off indexinig; and safety lock control, Marquette Div., Curtiss-Wright Corp.

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Anti-Friction Bearings—Catalog 424-D covering "the broadest line in the anti-friction field," is an 8-pp folder giving capsule presentation of company's entire product line. A brief description of each product is provided. SKF Industries, Inc.

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Flexible Couplings — Comprehensive selection data on flexible couplings is presented in 48-pp Engineering Catalog 60. Misalignment is described and basic coupling arrangements and load classifications are included, along with photos of couplings, etc. Thomas Flexible Coupling Co.

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LIGHTING, COMMUNICATION

Modern Lighting Needs—"Footcandles in Modern Lighting," is a 20-pp revised booklet giving lighting level recommendations for seeing tasks involved in hundreds of industrial and other activities. Figures are based on findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. Also discussed

Is clean, dry, oil free air

designed into your

Compressed air system?

Only with Adams Aftercoolers and Cyclone Separators can you get virtually **complete** removal of pipeline oil and water vapor — for these reasons:

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You pay no more for superior Adams performance because of Adams specialization in these units for over 25 years. They have engineered the extra features into mass-production techniques which keep unit costs down.

New Bulletin 714 merits your attention for the best possible protection to your air-actuated equipment. Write for your copy today.

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Maintenance general foreman to head plant maintenance department in a leading Eastern steel foundry. Should have at least five years experience in foundry or steel mill field and be well versed in modern day maintenance techniques. Mechanical or electrical engineering graduate preferred but will consider others of proper qualifications. Position is one of real challenge. Offers optimum opportunity and pays well. Send detail resume to Box 2078, c/o Plant Engineering, 308 East James St., Barrington, Ill.

PLANT ENGINEER

We have an interesting diversified job in the Plant Engineering Section for a young man with an M. E. Degree. If you have a few years experience in layout, machine design, estimating and fluid handling why not send us your resume.

Paper coating experience would be very helpful. This is an old established company with a good benefit program.

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Mechanical Ash Tray Light Sheet Metal Packs 6"x6"x1½". Will send blueprint, photo and Patent Copy. U. S. and Canada. Have models to loan for inspection. Waller - 833 Ashbury St., San Francisco 17, Calif.

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OVENS FOR INDUSTRY
• INDUSTRIAL FUME & DUST REMOVAL SYSTEMS
• WASHERS, OVENS, SPRAY BOOTHS
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Batch-type recirculating gas fired oven

Designers, Builders and Installers of Ovens to handle any industrial process, and built to the exact specifications determined by our complete engineering analysis of your job requirements.

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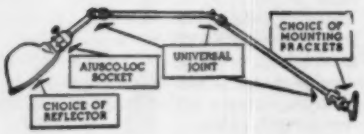
LOCAL LIGHTING FOR MACHINE AND BENCH

Easy to Use—Hard to Damage

Exclusive "AJUSCO-LOC" Socket



Ajusco-Loc Socket—Guaranteed not to break, kink, twist, or pull apart.

Put the Light where you want it—and it stays there—no sagging or slipping.

Eliminate costly repairs and lost time with these fixtures that stay on the job and out of the repair shop.

Write today for Catalog 66.
There's a "right" fixture for every job.

Adjustable FIXTURE CO.

Established 1911

AJUSCO MILWAUKEE WIS.

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LADDERS
made with
REYNOLDS ALUMINUM

Two things you want in a ladder: strength and light weight. And ladders made with Reynolds Aluminum give you both.

They're rugged, and last for years and years, because aluminum won't rust, splinter, or rot.

Aluminum ladders are easier to handle, too, because aluminum weighs much less than wood.

Specify ladders and scaffolds that are easy on your maintenance men, easy on your maintenance budget . . . ladders and scaffolds made with Reynolds Aluminum. For names of leading manufacturers, write *Reynolds Metals Company, P.O. Box 2346-NZ, Richmond 18, Virginia.*

Watch Reynolds new TV show "Harrigan & Son", Fridays; also "All Star Golf", Saturdays—ABC-TV

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DATA FILE

(Begins on page 232)

are other aspects of lighting to be considered. General Electric Co.
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Area Floodlighting — Planning for lighting of parking areas, construction sites, other open areas is detailed in 16-pp Bulletin 2719. Contains reference guides for selecting incandescent or mercury floodlights, general purpose or heavy duty types, and for determining how many floodlights are needed based on size of area to be lighted. Crouse-Hinds Co.
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Group Relamping Plan—Eight-pp Booklet A-6832 describes a group relamping plan designed to reduce costs, provide better lighting, and cause fewer work interruptions. Sample calculations provide data for setting up relamping schedule. Westinghouse Electric Corp.
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Lamp Data—Incandescent and fluorescent lamps are featured in this 16-pp bulletin. Selection tables list complete descriptive and electrical details. Champion Lamp Works.
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Vapor-Tight Fixtures—Presented in this 52-pp catalog supplement is a complete line of vapor-tight aluminum lighting fixtures. They include pendent, ceiling and bracket types for a variety of installations. Reflector styles—shallow bowl, standard dome or angle—are also described, and information on accessories, adaptor plates and hangers provided. Killark Electric Mfg. Co.
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Fixtures for Industry—Details of the CFI—comfort for industry—the uplight fluorescent lighting fixtures are covered in Form OD-1022, 16-pp. Typical installations, comparisons, size and types, and specifications are included. Day-Brite Lighting, Inc.
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Industrial Lighting—Construction features and advantages of localized lighting units for a variety of industrial applications are detailed in 12-pp Catalog 66. Dimensional data and illustrations are included. Adjustable Fixture Co.
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Lamp Annunciators — Outstanding features, operation, indications, mounting, relay cabinet (types, dimensions) relay plug-ins (operational sequences, types) audible signals (bells, buzzers, horns) and ordering information are covered in this 24-pp Bulletin 6041. Drawings, pictures and engraving data are included. Edwards Co., Inc.
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Communication System—Featured in this bulletin is a transistorized communication system designed to provide communication between two or more persons or departments regardless of distance or surrounding noise conditions. Gai-Tronics Corp.
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INSULATION

Flexible Pipe Insulation—This bulletin describes Armaflex 22, a flexible foamed plastic insulation for piping. Gives advantages, physical properties, thickness recommendations and sizes. Tells how to apply it to new or existing piping and fittings. Armstrong Cork Co.
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Insulation Specifications—This set of six specifications covers applications of Foamglas insulation for industrial equipment and piping. Each booklet contains tables of suggested thickness of insulation to be applied, drawings of installation procedure, supports, and recommended finishes. Booklets are devoted to low-, medium-, high-, and dual-temperature equipment and piping, to underground piping, and spheres. Pittsburgh Corning Corp.
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Acoustical Insulation—Described in this Product Bulletin F-190 is a fiber glass insulation designed for keeping duct systems quiet. Advantages are detailed. Pittsburgh Plate Glass Co.
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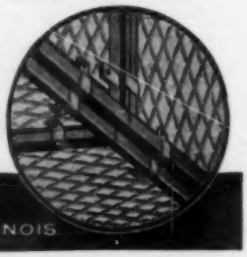
For Insulation Protection—Comprehensive data on mastics, coatings, adhesives, and flashing compounds for thermal insulation has been classified as to industry usage—power, process,

GLOBE SAFE·GARD (FORMERLY HILMAR) EXPANDED METAL PARTITIONS with exclusive QUIK-ERECT patented fittings

...will answer all your enclosure problems

Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe·*Gard* panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.



Note enlarged detail showing SAFE·GARD Quik-Erect Clips securely joining the interchangeable panels.

Write today for more details or call your Globe (Grip-Strut) Distributor.
Distributors in all principal cities, listed under "Grating" in your phone book.

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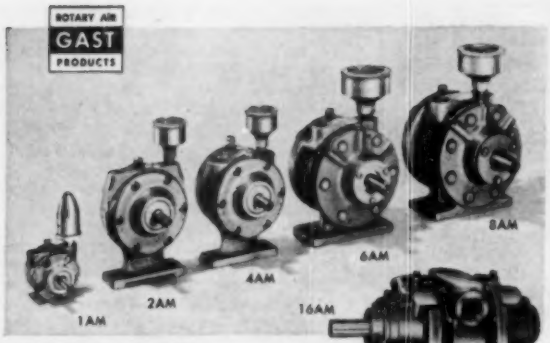

Six sizes . . . all
variable speed, explosion-proof

GAST AIR MOTORS

Need compact, low cost power? For plant use and original equipment applications, Gast rotary-vane Air Motors offer these distinct advantages:

1. Explosion-proof power. No danger!
2. Low initial cost per rated h.p.
3. Variable speed with valve control.
4. Can't burn out from overloads.
5. Vanes take up their own wear.
6. Reversible rotation (opt.) 5 sizes.
7. Very compact — light in weight.
8. Top-quality ball-bearing design.

TYPICAL PERFORMANCE		
Model No.	H.P. at 90 PSI 2000 RPM	Weight lbs.
1AM	0.13	1½
2AM	0.57	5½
4AM	1.1	8
6AM	2.0	17
8AM	4.0	25
16AM	7.0	65

Gast Manufacturing Corp.
P.O. Box 117-U,
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Write for Bulletins — specify models!

GAST ROTARY
"Air may be your answer!"
• AIR MOTORS TO 7 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.

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DUSTKOP "520"

designed to collect dust from single machines

portable — easily installed

DUSTKOP STOPS DUST

Self-contained Dustkop models like the "520," are practical and effective in collecting dust from single machines. They're designed specifically for service with surface grinders, tool and cutter grinders, offhand grinders, buffers and other small wheel equipment. These units are also easy to install — are actually portable — and very economical to operate.

Write for illustrated literature
46 models to choose from!

NEW DUSTKOP AUTO SHAKER shakes filters AUTOMATICALLY

AGET manufacturing company
1388 E. Church Street, Adrian, Michigan

ask for details

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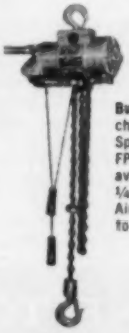
CUT YOUR COSTS

. . . let us help you save on every hoisting operation

ELECTRIC HOISTS

Push Button Budgit Electric Hoist. For regular hoisting service. Portable. Hang up, plug in, and use. Two fully enclosed automatic brakes give fast, accurate spotting. ½-ton model lifts at 34 FPM. Hook suspension. ⅛ to 2 tons.

Load Lifter Wire Rope Electric Hoists. ½ to 15 tons. Safe 24-volts at the push-button. Single and 2-speed control. Two automatic brakes. Lug or hook suspension; also with push, hand-geared or motor-driven trolley. Hi-hook model, too.



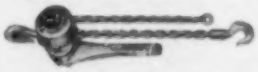
AIR HOISTS

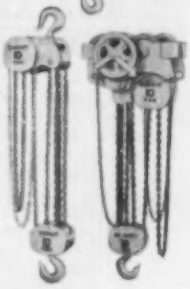
Budgit Air Hoist. Link and roller chain types. Pendant cord control. Speeds infinitely variable to 75 FPM. Rigid mount push trolley available. Safety hooks standard. ¼, ½ and 1 ton. Also Load Lifter Air Hoists with wire rope load line to 15 tons.

CHAIN BLOCKS

Budgit Chain Blocks. ¼ to 10 tons. Light, tough aluminum frame. 25 lb. pull on hand chain lifts 500 lbs. Fast action load brake makes lowering easy. Hook suspension or Army type trolley.

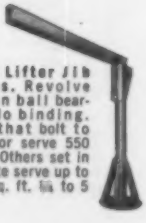
Tugit Lever-Operated Hoist. Light, compact, portable. Easy to operate even in close quarters — lifts or pulls at any angle. A fine maintenance tool. ¾ to 3 tons.





BUILD-IT-YOURSELF CRANE ASSEMBLIES

Budgit Crane Assemblies. Low-cost "build it yourself" kits to construct single girder cranes up to 6 tons and 30 ft. span without special tools. You buy I-beam locally to save more. Packaged electric bridge drive adds efficiency. Kits also for 180° swinging bracket jib cranes up to 4½ tons, 10 ft. reach.



Load Lifter Jib Cranes. Revolve 360° on ball bearings. No binding. Types that bolt to the floor serve 550 sq. ft. Others set in concrete serve up to 1500 sq. ft. ⅛ to 5 tons.

END YOUR LIFTING PROBLEMS

Phone your Shaw-Box Distributor for help in selection or write us direct for literature.

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OVERHEAD HANDLING EQUIPMENT

Products of
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Shaw-Box Crane & Hoist Division • Muskegon, Michigan
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

For more facts circle 641 on Reply Card

DATA FILE

(Begins on page 232)

cold storage, marine and commercial —in this ready-reference loose-leaf manual, about 208-pp. Detailed application information and product data is included, as well as illustrations of uses. Benjamin Foster Co.

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FANS, VENTILATING AND AIR CONDITIONING

Propeller Fans—Design features and applications of heavy-duty propeller fans and related packaged units are detailed in 24-pp Bulletin FM-2345. Photos show a widely diversified range of uses. Buffalo Forge Co.

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Acoustically-Controlled Fan—The AcoustaFan, which features a flow-nozzle air foil wheel designed for quiet operation, is described in Bulletin 592. Quiet zone selection tables help select quietest possible fan for particular installation. The New York Blower Co.

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Industrial Fans—Bulletin 690-A, 12-pp, contains dimensions and application and performance data on direct connected fans for general and system ventilation and power roof ventilators. Propellair Div., Robbins & Myers, Inc.

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Postage-free Reader Service Cards make it easy to order catalogs. Cards are provided on pages 227 and 228.

Centrifugal Fans—Catalog 1120-1 contains 76-pp of detailed information on all-purpose centrifugal fans with flat, backwardly inclined blading, suited for supply and exhaust, general building ventilation, industrial processes. Key components and features are illustrated, and sizes included. Sturtevant Div., Westinghouse Electric Corp.

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Air Moving Equipment—Bulletin DB-45, 20-pp, contains detailed information on company's line of roof ventilators, bifurcators, axial flow vent sets, and air jets. Bonded performance ratings are listed on table, and sizes given. DeBothezat Fans Div., American Machine and Metals, Inc.

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Propeller Fans—Twenty-pp Catalog DB1-100 describes direct-drive, self-cooled motor propeller fans, including high and low speed units, explosion-proof and tubeaxial type. Dimensions and tables showing recommended air changes included. Ilg Electric Ventilating Co.

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Fan Sets—Bulletin 502 describes compact ready-to-run fan sets designed for applications which involve handling of clean air at temperatures to 200 F, volumes from 100 to 7500 cfm, and static pressures to 2 in. Low speed multiblade wheels or medium speed backward inclined blade wheels are included. Clarage Fan Co.

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Centrifugal Roof Exhausters—Bulletin 60-CK describes centrifugal power roof exhausters featuring reduction in overall exhauster height. Air moving capacities for 141 models are given, along with dimensional and curb mounting drawings, electrical characteristics and optional accessories. Jenn-Air Products Co., Inc.

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Air Conditioning Units—Bulletin 786 contains 54-pp of selection data on air conditioners, including capacities, standard arrangements, dimensions, etc. Steps in selection of basic unit and components are outlined. First pages are devoted to choosing physical size based on air capacity and face velocity requirements. Succeeding pages concern themselves with heating and cooling requirements. American Air Filter Co., Inc.

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DUST, FUME CONTROL

Dust Collectors—Self-contained cabinet cloth-filter type dust collectors are illustrated and described in this 6-pp Bulletin 359. Design details included. Torit Mfg. Co.

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A NEW MACHINE TOOL moves into industry!

This photograph shows the motor and fan assembly of a Super Suction® Model BP-2 Suction Cleaner mounted on a standard 55 gal. steel drum. The Super is positioned beside a punch press where the powerful suction provides a continuous collection of scrap from the die punch. Instead of frequent stopping to remove scrap, the press remains in *continuous* operation, increasing unit production and reducing unit cost.

This is *only one* of an almost infinite variety of production operations—recovery of cutting fluids from sumps, transfer of materials and liquids, cleaning parts—now being done by Super cleaners in manufacturing plants today. Every plant contains many operations where costly time can be saved by a powerful air stream used for suction or blowing. The ability of the cleaner to handle both wet and dry materials and liquids makes its use possible over a very wide range of cost saving operations in any factory.

Two Super Models BP-2 and RS-1 are specially designed for production duty. Adaptor covers, making it possible to mount one or more motor and fan assemblies on the steel drum, are available. Both cleaners can also be used for general floor and plant cleaning. Write for catalogs and complete data. Or ask your Super local distributor.

"Once Over Does It"

SUPER SUCTION SERVICE®

Power Suction Cleaners • Quality Floor Machines

SINCE 1911

"THE DRAFT HORSE OF POWER CLEANING MACHINES"

THE NATIONAL SUPER SERVICE COMPANY

1942 N. 12TH STREET, TOLEDO 2, OHIO

In Canada: Plant Maintenance Equipment Co. Toronto, Montreal, Vancouver

SALES AND SERVICE IN PRINCIPAL CITIES

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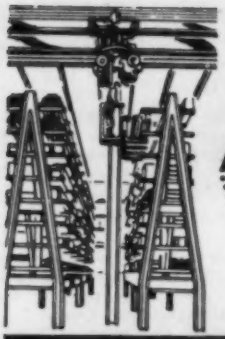

use your Air rights . . .

INCREASE HANDLING EFFICIENCY, SPEED MATERIAL MOVEMENT, SAVE SPACE, TIME, MONEY WITH

TRAK-RAK®

A TRAK-RAK System saves valuable floor area by permitting vertical material storage and handling, yet provides faster, safer in-and-out of storage handling than on the floor operation. TRAK-RAK gives you better inventory and parts control, lowers handling costs, improves material delivery. Over 200 TRAK-RAK systems installed in companies like Alcoa, Carson Pirie Scott & Co., Chain Belt Co., Du Pont, Westinghouse, General Electric, etc.

Write for complete details on the TRAK-RAK system of vertical storage and handling.

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1324 S. Kostner Avenue • Chicago 23, Illinois

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JOY ELECTRICAL CONNECTORS

outlast attachable connectors

12 to 1!

FREE - COMPLETE RESULT AND ACTION PHOTOS OF GRUELLING TORTURE TEST!

Joy molded-to-cable and competitive attachable connectors were tested on a revolving torture wheel to determine fatigue resistance. Conclusive results prove Joy connectors outlast competitive models 12 to 1 . . . save your money with much longer life, less down-time, fewer repairs.

Get proof of real connector durability and savings . . . write Today for test details (Bulletin F52).

CD 660.2

JOY ELECTRICAL PRODUCTS DIVISION
1211 Macklind Ave., St. Louis, Mo.
Exec. Offices, Henry W. Oliver Bldg. Pgh., Pa.

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The Bumper takes the Shock—Not the Door

CLARK

Shock Absorber Door

Fed up with Impact Doors that rip, warp or come off the fastenings?

The Shock Absorber Door withstands *hundreds of thousands* of openings with no costly "time-outs" for repair. Constant pounding by heavily laden fork trucks can't weaken the hinges, the frame or the Door itself. Because the trucks *never touch* the Door.

Impact is absorbed by Urethane-Foamed Bumpers. The Door *rides with the punch* on flexibly suspended hinges. Pedestrian traffic can open the lightweight, rigid Door with gentle pressure. In either case, the unique Spring Retriever returns it unfailingly to tight closure. Neoprene seals at all edges keep wanted air IN — unwanted air OUT.

It will pay you to investigate the advantages of a Door that keeps traffic *moving*, without slowdowns or bottlenecks. Needs virtually no maintenance. Complete in one unit. Installs easily. No extras to buy.

Learn why so many Blue Chip companies, after purchasing one Door, have reordered several more. See our insert in Sweet's Catalog or, better still, write us today for full data. Please specify dimensions.

CLARK DOOR COMPANY, INC. (since 1878)
507 Hunterdon St., Newark 8, N. J.

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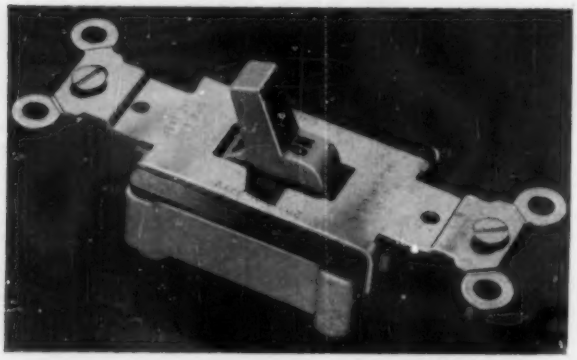
SMOOTH CAM ACTION KEEPS THIS NEW GENERAL ELECTRIC A-C SWITCH "QUIET AS NEW"

Notice there are no "bumpers" of elastic material in this new General Electric 20-A switch.

It's a big improvement over other a-c switches that need bumpers to deaden the "snap" of toggle actions — because bumpers get noisy, when they harden with age.

This new G-E switch has a long-lasting *cam* action that's quiet to start with, and stays that way!



Use it whenever you want a better 20-A, a-c switch. You get tighter, safer Pressure-Lock* terminal connections — arc-resistant construction — extra-shallow design — captive mounting screws. No. GE5451; Specification Grade; 20A, 120/277V AC; U.L.-listed; meets Federal and REA specifications. Your local distributor has them in stock. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

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DATA FILE

(Begins on page 232)

Dust, Fume Control—A wide range of industrial dust and fume producing processes that can be successfully controlled with the properly designed cloth or glass bay-type dust collectors is covered in 24-pp Bulletin 562-D. Operating principles are illustrated. Wheelabrator Corp.

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Dust and Mist Collectors—Illustrated and described in this fold-out chart-size Bulletin 736 is company's line of dust and mist collectors and accessory equipment. Detailed specifications are included. Aget Mfg. Co.

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Dust-Free Handling—Featured in Bulletin V-100 is the Verticone, a conditioner unit for dust control, designed to apply on-the-spot conditioning to dusty materials in all types of handling. Explains how the Verticone works, illustrates construction features, gives applications and materials (cokes, flue dust, clay, ores, limestone and sand). Johnson-March Corp.

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PROCESSING EQUIPMENT

Air Processing Equipment—Bulletin S-5 contains 12-pp of data on such equipment as ovens, dryers, air heaters and curing systems for use in pulp and paper, paint finishing, rubber and foam rubber, foundries, plastics and chemical processing. Case histories of tough drying or curing problems are given. J. O. Ross Engineering, Div. Midland-Ross Corp.

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Propeller Type Mixers—Portable and fixed mounting propeller type mixers are illustrated and described in Bulletins B-520 and B-521. Dimensional data and diagrams are included. Mixing Equipment Co., Inc.

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Corrosion Resistant Equipment—Featured in 20-pp Bulletin CE-50 are charts to aid in selecting of corrosion resistant processing equipment, based on factors of chemical resistance, physical properties and economy. Materials covered include rubber-lined steel, hard rubber, rubber plastic, vinyls, Saran and polyethylene. Resistance charts cover acids, bases, amines, esters, hydrocarbons, ketones, phenols, others. American Hard Rubber Co., Div., Amerace Corp.

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Control Feeding—Weighing, batching and proportioning systems for controlled weights and rates of material flow in industry are described in 48-pp Catalog 941. Includes dimensional diagrams and specifications on constant weight feeders, rotary bin check valves, bin level indicators, batch weighing systems, batch proportioning systems, vibrating feeders. The Jeffrey Mfg. Co.

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Process-Variable Automation—Eight-pp Bulletin F-1892 describes a pneumatic system for adjusting motor speeds automatically to maintain selected process-variables within specified limits. Among variables thus maintained are heat, tension, weight, humidity, pressure, position, liquid levels, cutting speed, liquid flow, and others. U. S. Electrical Motors Inc.

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OTHER EQUIPMENT

Industrial Stack—Detailed information on a permanent, low cost refractory smoke stack for commercial and industrial applications is contained in 8-pp Bulletin IS-32. Gives product information, applications with boilers, furnaces, etc. VanPacker Co., Div., The Flintkote Co.

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EXECUTIVE REPORT #27

When the Code Requires a "Clean Stack"

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DUST AND FUME CONTROL

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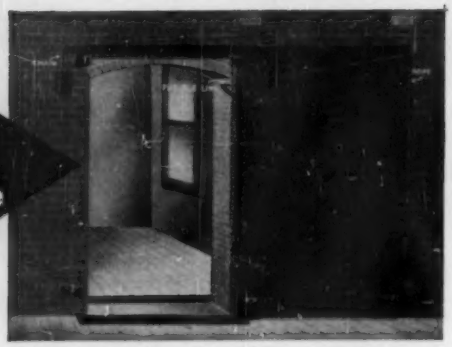

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7497
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DATA FILE

(Begins on page 232)

For Cleaner Furnace—The use and application of Oxi Crystals to keep furnaces and the fireside of boilers free of slag, encrusted carbon, soot, and fire-scale is described in a recent pamphlet. Oxi-Kor Corp.

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Product Guide—This 26-pp booklet is designed to show the wide range of products manufactured by the Company. It contains an alphabetical listing of the products, with reference to engineering literature available. Allis-Chalmers Mfg. Co.

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Automatic Air Products—Featured in 22-pp Bulletin 157 are automatic air products, including separators, after-driers, filtrators, filters, line drains, governors and kits, combinations, regulators, and lubricators. Advantages are detailed and operation described. Wilkerson Corp.

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Vertical Transportation—Selection of vertical transportation for every traffic-moving job is detailed in 32-pp Bulletin A-382. Various types of elevators and escalators for a variety of commercial and industrial applications are described. Otis Elevator Co.

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Product Directory—Product Directory G-103 covers company's divisions and products. Products are divided into major sub-groups—chain link fence, chemicals and coke, springs, belts, wire, wire cloth, etc. Brand names are given, as well as applicable reference literature. The Colorado Fuel and Iron Corp.

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Filtration for Liquids, Gases—Eight-pp Bulletin GEO-506A describes a line of filtration equipment for liquids and gases. Information is classified according to applications, operating pressures, etc. Commercial Filters Corp.

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Wire Rope Advantages—Advantages and economies of company's wire rope for all uses are detailed in this products bulletin. Various types and constructions are covered and strength and weight charts included. Leschen Wire Rope Div., H. K. Porter Co., Inc.

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Pneumatic Products—Catalog 616E contains 22-pp of comprehensive information on company's pneumatic products, including filters, regulators, lubricators, combination units, air relief valves, air strainers and accessories. Specifications are given, as well as curves showing performance characteristics. Watts Regulator Co.

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Cyclone Separators—Featured in 8-pp Bulletin 712 are company's cyclone separators and pipe line after-coolers designed to provide cool, dry and clean compressed air and gases. Cutaway views illustrate component parts and features, and capacity tables facilitate selection. R. P. Adams Co., Inc.

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Preheating Combustion Air—This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels effectively. Air Preheater Corp.

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Felt Products—This 22-pp bulletin discusses felt as a design material, covering properties of felt and applications in industry, as a friction material, for cushioning, filtering, insulating, sealing, spacing and wicking. Selection and specification data included. The Felters Co.

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Nickel-Chromium Alloy—Detailed information is contained in Technical Bulletin T-38, 36-pp, on Inconel X, an age-hardenable nickel-chromium alloy. Physical and mechanical properties, applications, specifications, available forms, and design data are given with graphs. Huntington Alloy Products Div., The International Nickel Co., Inc.

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Aluminum Alloy Anode—Bulletin TP-115-E describes HP-4, an aluminum alloy galvanic anode for protection of tanks against sea water. Details lower amp-hour cost and other benefits afforded and compares electro-chemical properties of HP-4 with zinc and magnesium. Electro-Rust-Proofing Corp.

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Double-Flow Aquatower—Bulletin DFA15-60 describes company's double-flow Aquatower designed to bridge the gap between standard double-flow Aquatowers and unlimited capacity industrial cooling towers. Specifications and engineering data included. The Marley Co.

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Galvanized Steel Sheets—Characteristics and advantages of Ti-Co non-flaking galvanized steel sheets designed for use in all types of products where corrosion resistance is required are detailed in this 10-pp product bulletin. Typical applications in sheet metal work are illustrated and sizes produced are listed. Inland Steel Co.

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Absorption Cold Generator—Featured in 20-pp Catalog DS-435 is a completely hermetic, packaged absorption refrigeration machine which uses low pressure steam to produce chilled water for air conditioning and process applications. Design and operation diagrams are included, as well as selection, capacity data, dimensions and specifications. The Trane Co.

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Speed-Draw Press—Features and advantages of company's speed-draw presses for high-production deep-draw work are outlined in 8-pp Catalog 2029A. A fold-out chart gives detailed specifications on the equipment. The Cleveland Crane & Engineering Co.

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Filters, Strainers—Industrial Catalog 1058, 48-pp, provides application and engineering information on company's line of micro-filters and precision strainers. Fuel filters, full flow and by-pass lube filters, dry type air filter, air separators, and metal edge strainers shown. Purolator Products, Inc.

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Productive Maintenance Records—Visible signal controls for spotlighting maintenance schedules are described in this 8-pp bulletin SB-43 on productive maintenance record systems. Various sets of forms used by business and industry are pictured. Acme Visible Records, Inc.

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Corrosion Control Tips—Control of water problems in air conditioning system—scale formation and slime and algae growths—is discussed in Bulletin 596. Offers suggestions for the control of these problems through adequate, planned chemical treatment. Application information as well as control testing data are included. Betz Laboratories, Inc.

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Teflon Hose Assembly—Advantages of company's Springfield 120 Teflon hose assembly are detailed in this illustrated bulletin. Assembly procedure is pictured and described and design specifications tabulated. Titeflex, Inc.

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Sling Chain Assemblies—Bulletin CSA-1 gives data on "customized" components for assembling sling assemblies to suit requirements. Tells steps to follow in making a chain assembly and provides assembly chart giving load limits, chain, hooks, etc. Photos illustrate use of Wedglok coupling link assembly. Campbell Chain Co.

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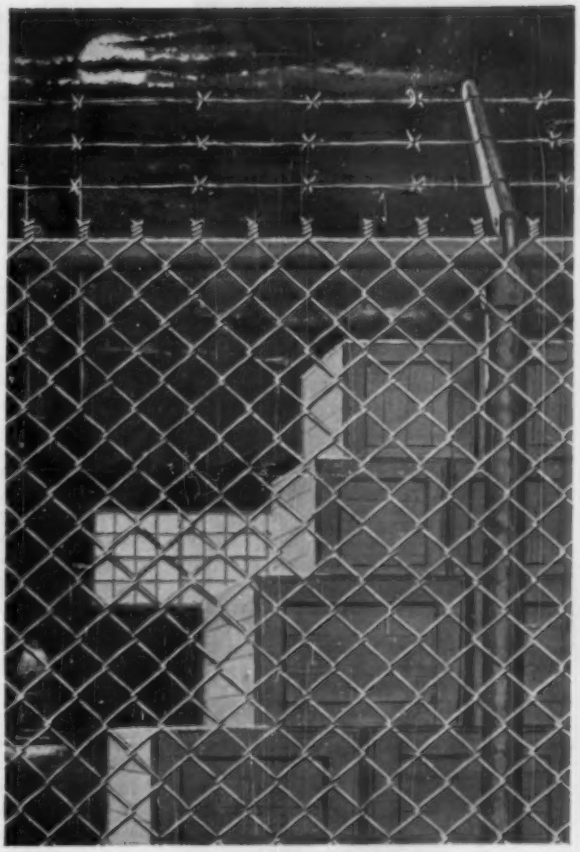

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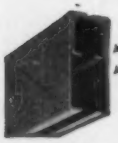

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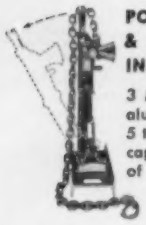

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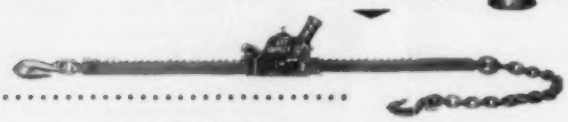

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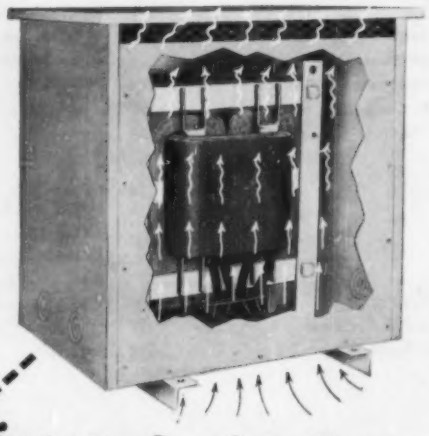

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Optional monitor lights give visual evidence of proper performance. Simple dynamic sequence tester checks individual NOR units in operation.

UNMATCHED SPEED

NORpak provides switching at rates up to 25,000 per second—faster than any other industrial static system.

EXPERT APPLICATION HELP

Field specialists, factory-trained in all aspects of **NORpak** can give you on-the-spot answers to any application questions.

SMALLEST COMMERCIAL PACKAGES

NORpak is available in the form of individual components, or in completely engineered systems. Components are offered in 6 and 20 paks, require only 1/4th the equivalent relay panel space, and weigh less than components of other static systems.

NORpak is available as individual components for application to specific control functions, or as completely engineered systems ranging from the smallest to the largest panels

Write for the complete story on **NORpak** *—its theory, application and operation... Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin*

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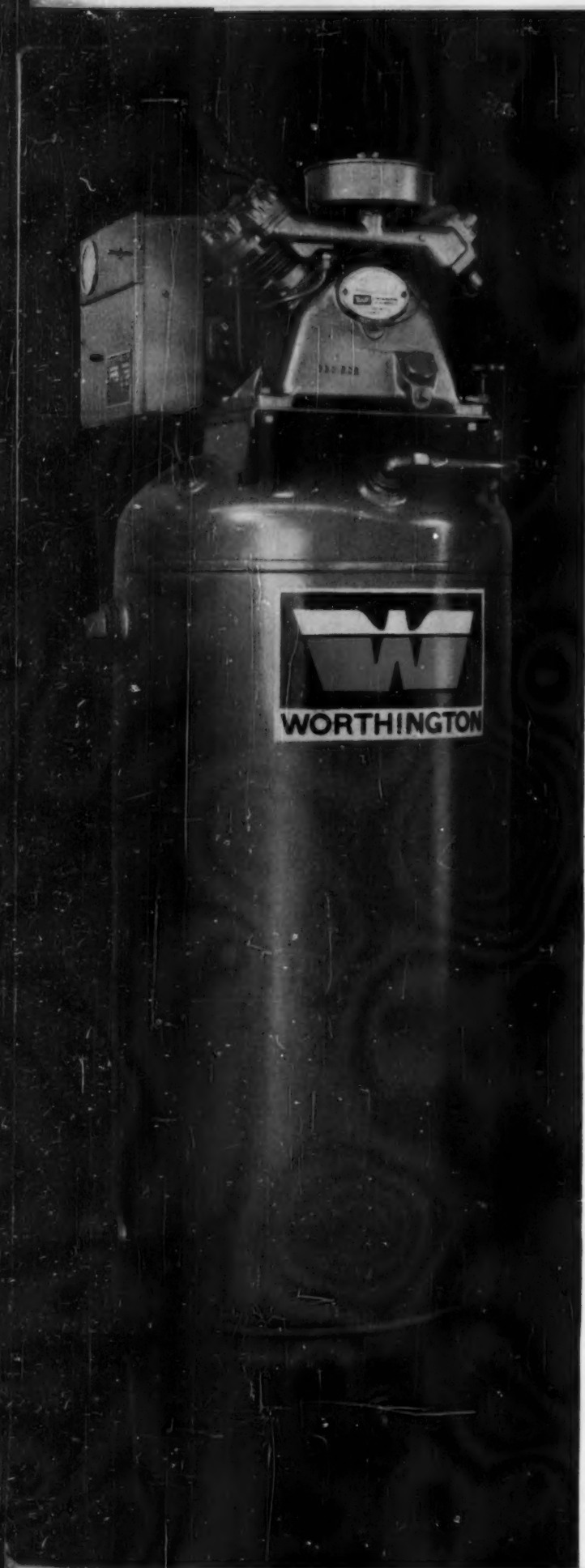

BEST BUY FOR CHEAP AIR

UP TO 5hp... NEW WORTHINGTON MONOBLOC X COMPRESSOR

Based on purchase price, on extremely long compressor life . . . and on safety, too . . . your best buy for a 1½- to 5-h.p. air supply is the new Worthington MONOBLOC X-Compressor.

First, the MONOBLOC saves you $30 or more for parts and labor because it comes completely wired. There's no starting switch to buy and install and wire in.

It's more economical, too, because all your money goes to buying a quality motor, compressor, controls and tank. You don't waste it on unnecessary belts, belt-guard, sheaves, long base and on the labor required for assembling them.

Is floor space important to you? The MONOBLOC vertical tanks save over 60% of space required by old-style horizontal units. A 10" radius circle for the 60-gal. tank; a 12" radius circle for the 80-gal. tank.

The MONOBLOC costs less to run. All power goes to the compressor—no power loss in belt friction. (No belt guards or belt replacements.)

Of course, you want long compressor life. The MONOBLOC is built with the new Worthington X-Compressor design that virtually eliminates harmful vibration. The wide-stance X-shape design reduces vibration to the point where a coin can be balanced on the unit during starting, running and stopping.

A silicon-treated filter element removes over 99% of the dirt from incoming air—the most dangerous source of compressor wear. Tapered roller bearings cut friction. The large lubricating oil sump permits better cooling, less danger from low oil supply. These and other design features assure extremely long compressor life.

We and our distributors are ready and happy to show you why there's no better way of buying cheap air today. Call the Worthington Distributor listed in your Yellow Pages. Worthington Corporation, Section 34-7, Holyoke, Massachusetts.

WORTHINGTON

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